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DIGITAL DATA PROCESSING SYSTEM OPERATION AND MAINTENANCE MANUAL

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SECTION I
GENERAL DESCRIPTION

1-1. GENERAL INFORMATION

A. SCOPE OF MANUAL

This manual contains information necessary to install, operate, and maintain the digital data processing system furnished to Project Mercury ground instrumentation sites by Bendix-Pacific Division of The Bendix Corporation, North Hollywood, California.

The three subsystems comprising the digital data processing system are described, their functions at the various sites discussed, and their theories of operation detailed.

Operational and maintenance procedures for each subsystem are included, as well as illustrations of equipment and diagrams of digital data processing site and equipment layouts. Interconnecting cabling and wiring diagrams are also included.

The individual items of equipment furnished and their respective handbooks are listed in tabular form as a reference guide to facilitate operation and maintenance procedures beyond the scope of this manual.

B. PROJECT SCOPE

The Project Mercury Program, concerned with the task of placing a manned space vehicle into orbital flight, monitoring the condition of the astronaut and the capsule during orbital flight, and

safely returning the capsule occupant to earth, utilizes a world-wide system of radar tracking, digital data processing, communications, telemetered data receiving, processing, and display stations.

In addition, a communications and computing center serves to integrate the tracking data supplied by the stations. The control center at Cape Canaveral is used as an operational center for the entire network.

The world-wide tracking/monitoring system includes sixteen ground instrumentation sites (see figure 1-1). Digital data processing is provided at twelve of the stations. All stations are linked to the computing and control centers by voice and teletype communications networks. A demonstration site at Wallops Island is furnished with equipment necessary to illustrate the operation of a Project Mercury Command Site.

C. SITE FUNCTIONS

The Project Mercury ground instrumentation sites are grouped into six categories according to their primary function in the mission. These categories, representing one or several sites with basically similar equipment implementation, are defined as Command, Non-Command, Down Range, Computer, Launch, and Demonstration sites. A brief functional description of the various site categories is contained in Table I-1. Detailed physical and functional descriptions of the digital data processing system are presented in paragraphs 1-3 and 1-4.

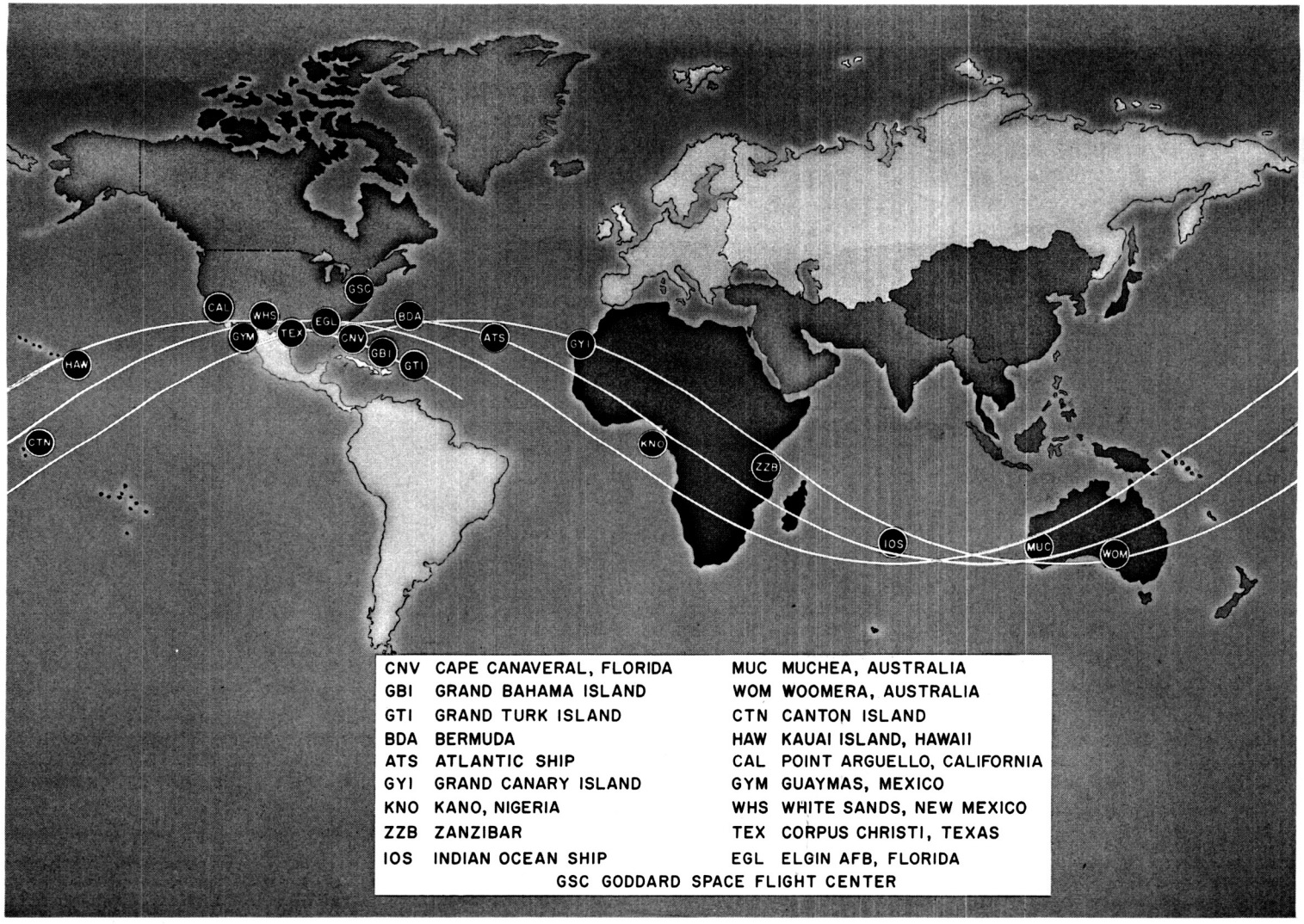


Figure 1-1 Project Mercury Ground Instrumentation Sites and Orbits

TABLE I-1. SITE FUNCTIONS

SITE	TYPE	FUNCTION
Muchea, Australia Kauai Island, Hawaii Point Arguello Guaymas, Mexico	Command	Command sites provide tracking, digital data processing, telemeter, and voice communications with the capsule, and transmit command functions as required. Data transmission between sites and the computing center is provided.
Grand Canary Island Woomera, Australia Corpus Christi, Texas White Sands, New Mexico Eglin, Florida	Non-Command	Non-command sites receive capsule telemetry signals and maintain voice communications with the capsule as required. Digital data processing and transmission to the computing center is provided. Telemetered data peculiar to command functions is not handled at non-command sites.
Bermuda	Computer	The computer site has the capability of determining if the capsule has been placed into an acceptable orbit and to effect an abort landing in one of the major recovery areas if the trajectory is not acceptable. Tracking, digital data processing, computing, telemetry, and command equipment is provided with the capability of performing these functions essentially independent of launch site data.
Cape Canaveral	Launch	The launch site serves as control center providing control and coordination of all activities associated with the Project Mercury operation. From prelaunch through insertion, summary teletype data from all telemetry and tracking stations will be received and the station will perform the functions of a command site.
Goddard Space Flight Center	Computing Center	The computing center receives time-coded teletype messages from the ground instrumentation sites consisting of capsule radar tracking data. High-speed data is also received. All information is computed to determine and predict the position of the capsule during its orbital flight.
Demonstration Site	Demonstration	Project Mercury equipment will be demonstrated at this site. Equipment installed is similar to that at a command site.

D. DIGITAL DATA PROCESSING SYSTEM FUNCTIONS

The Project Mercury digital data processing system furnished by Bendix-Pacific consists of three subsystems. Each subsystem provides a separate function in the accomplishment of the Project Mercury mission.

The first subsystem provides equipment which permits conversion of radar tracking information to information suitable for teletype transmission from the ground instrumentation sites to the computing center. The equipment employed to accomplish this function comprises the Digital to Teletype Conversion Subsystem.

High-speed data transmission and receiving equipment comprise the second subsystem; High-Speed Data Transmission Subsystem. The equipment provides real time transmission of tracking information to computing or conversion equipment.

The third subsystem prepares telemetry and time information for application to computing equipment and is designated the Preparation of Telemetry and Time Information Subsystem.

All Project Mercury ground instrumentation sites employing digital data processing equipment are furnished with the digital to teletype conversion subsystem. The high-speed data transmission and preparation of telemetry and time information subsystems are provided only at Cape Canaveral and Bermuda. The demonstration site at Wallops Island is furnished with the equipment necessary to demonstrate the operation of the first two subsystems described in the above paragraphs.

1-2. EQUIPMENT SUPPLIED

The data processing equipment furnished by Bendix-Pacific Division and the associated equipment handbooks are listed in Table I-2. The reference designation in the last column is provided for handbook identification at Project Mercury sites. Illustrations of the equipment supplied are shown in figures 1-2 through 1-12.

TABLE I-2. LIST OF MAJOR DIGITAL DATA PROCESSING EQUIPMENT SUPPLIED AND APPLICABLE HANDBOOKS

UNIT	MANUFACTURER AND MODEL NO.	BENDIX-PACIFIC ASSEMBLY NO.	INSTRUCTION HANDBOOK	REFERENCE DESIGNATION
Digital-To-Teletype Converter	Milgo, 165	1068563	Instruction Manual for Digital-To-Teletype Converter, Milgo 165	ME 405
Data Transmitter	Milgo 4008-1A	1068562-1	Instruction Manual for Data Transmitter (FPS-16)	ME 402
Data Transmitter	Milgo 4008-1B	1068562-2	Instruction Manual for Data Transmitter (Verlort)	ME 401
Data Receiver	Milgo 4008-2A	1068561-1	Instruction Manual for Data Receiver (8-Bit)	ME 403
Data Receiver	Milgo 4008-2B	1068561-2	Instruction Manual for Data Receiver (36-Bit)	ME 404
Tape Recorder/ Reproducer	Ampex FR 1107	1068566	Instruction Manual for Series FR-1100 Recorder/Reproducer	ME 406
Radar Data Control Unit (Single)	Bendix-Pacific	1068715	Instruction Manual for Radar Data Control Unit (Single)	ME 408

TABLE I-2. LIST OF MAJOR DIGITAL DATA PROCESSING EQUIPMENT SUPPLIED AND APPLICABLE HANDBOOKS (Continued)

UNIT	MANUFACTURER AND MODEL NO.	BENDIX-PACIFIC ASSEMBLY NO.	INSTRUCTION HANDBOOK	REFERENCE DESIGNATION
Radar Data Control Unit (Dual)	Bendix-Pacific	1068720	Instruction Manual for Radar Data Control Unit (Dual)	ME 407
Radar Data Control Unit (Eglin)	Bendix-Pacific	1068720	Instruction Manual for Radar Data Control Unit (Eglin)	ME 409
Telemetry/Event Buffer (Bermuda)	Bendix-Pacific	1068600	Instruction Manual for Telemetry/Event Buffer (Bermuda)	ME 411
Telemetry/Event Transmitting Buffer (Cape Canaveral)	Bendix-Pacific	1068601	Instruction Manual for Telemetry/Event Transmitting Buffer (Cape Canaveral)	ME 903

1-3. DESCRIPTION OF DIGITAL DATA PROCESSING EQUIPMENT

A. GENERAL

The digital data processing equipment furnished to the Project Mercury ground instrumentation sites consists of individual units installed according to prescribed operational requirements for each site. This manual describes, illustrates, and provides operation, maintenance, and installation instructions for the individual units on a systems level. Specific information concerning the individual units is contained in the individual equipment operation and maintenance manuals referenced in Table I-2.

The following description of the Project Mercury digital data processing system includes physical and functional descriptions and illustrations of individual items of equipment. Reference to paragraph 1-4 and Table I-3 will provide information relating to individual site equipment allocation and implementation.

B. DIGITAL-TO-TELETYPE CONVERTER

(1) PHYSICAL DESCRIPTION - The digital-to-teletype converter (figure 1-2) is contained in a 24 by 22 by 77-1/8-inch cabinet weighing approximately 450 pounds. All controls and indicators are mounted on the front panel. External cable connectors are located at the rear of the cabinet and are accessible by removing a portion of the front panel. A blower is installed in the bottom of the cabinet for positive pressure ventilation.

(2) FUNCTIONAL DESCRIPTION - The converter accepts digital information from Verlort, FPS-16, or MPG-31 radars, or a 4008-2B data receiver consisting of azimuth, elevation, and range data.

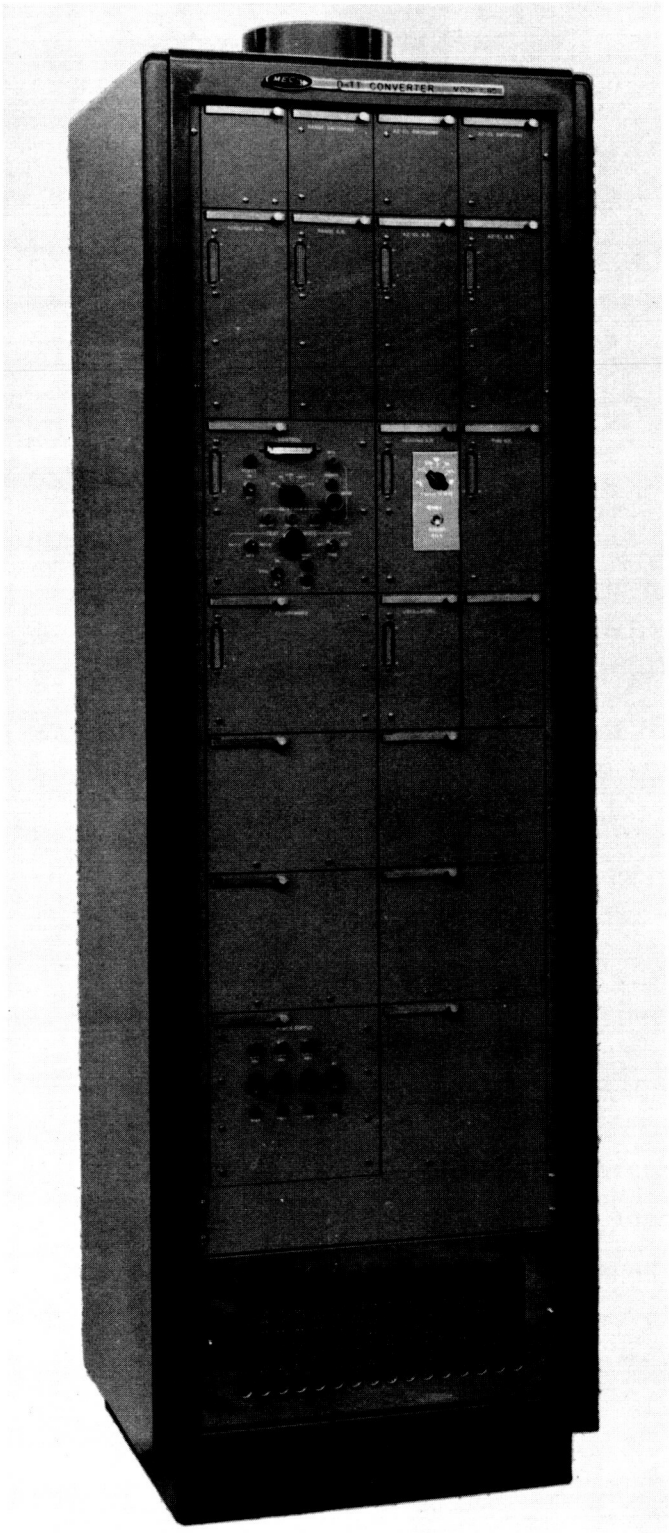


Figure 1-2. Digital-to-Teletype Converter

The information is then converted to start/stop teletype signals for transmission over a teletype sending circuit. The converter also supplies heading information to the teletype output. The signals are time-identified at the converter by means of inputs from a time generator which supplies the time of day in hours, minutes, and seconds.

C. RADAR DATA CONTROL UNITS

(1) PHYSICAL DESCRIPTION - The radar data control units (figures 1-3 and 1-4) are contained in 8-9/16 by 9-3/16 by 13-inch cabinets suitable for desk-top installation. All controls and indicators are mounted on the front panels of the units. Internal components are accessible by sliding the chassis and front panel out of the cabinet front.

(2) FUNCTIONAL DESCRIPTION - Three types of radar data control units are furnished to the Project Mercury ground instrumentation sites. The first is for use at ground instrumentation sites employing two radars. This unit provides the necessary controls and indicators to select and control the outputs of two digital-to-teletype converters. The second type of radar data control unit controls the output of one digital-to-teletype converter. The third is a special unit designed for Eglin. It provides switching and control of two converter outputs for transmission to the normal teletype sending line in addition to a special secondary data sending line terminating at Cape Canaveral.

D. DATA TRANSMITTER

(1) PHYSICAL DESCRIPTION - The high-speed data transmitters (figures 1-5 and 1-6) are contained in 24 by 22 by 77-1/8-inch cabinets weighing approximately 500 pounds. All controls and indicators are mounted on the cabinet front panel. Signal cable connectors

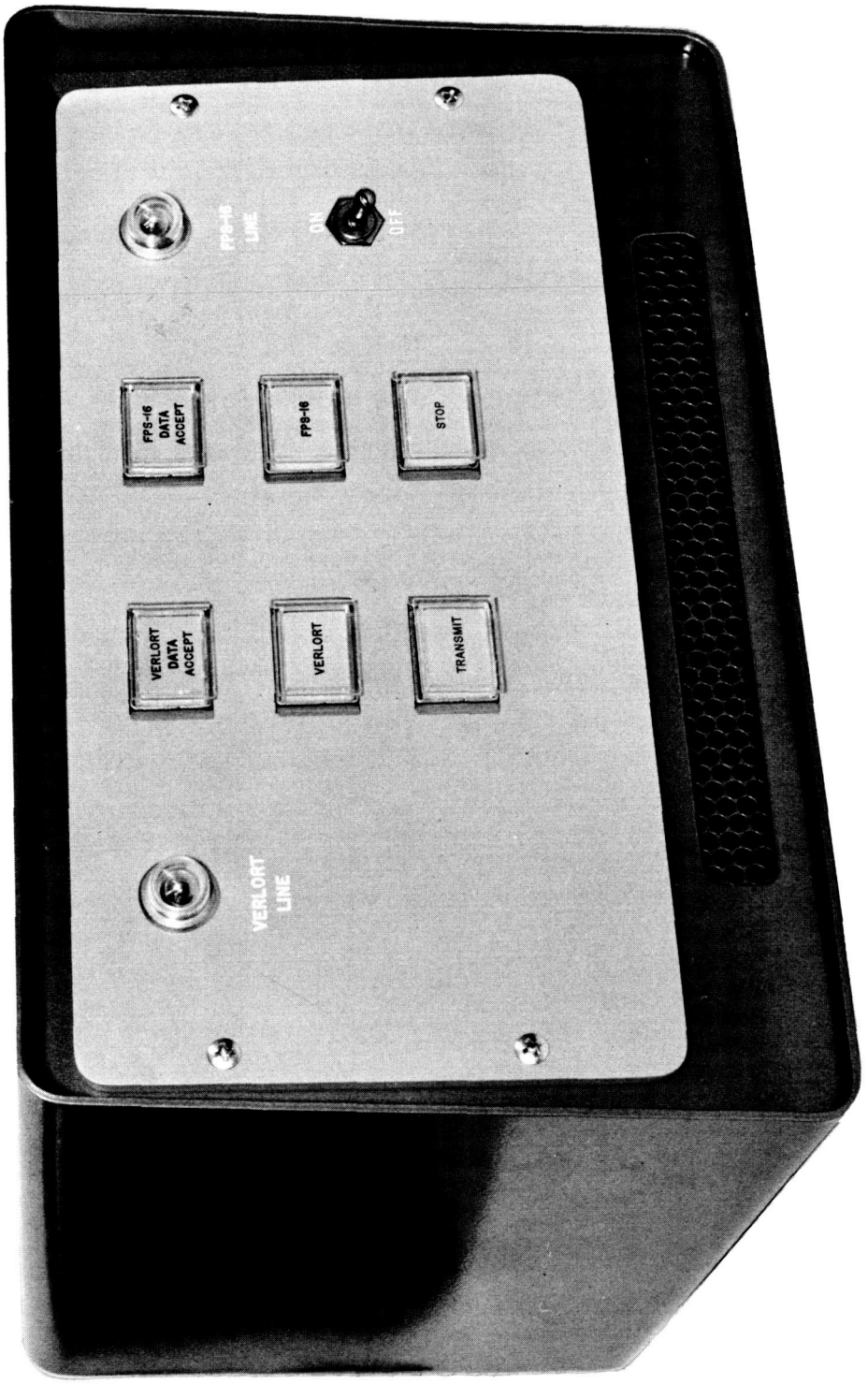


Figure 1-3. Radar Data Control Unit (Dual)

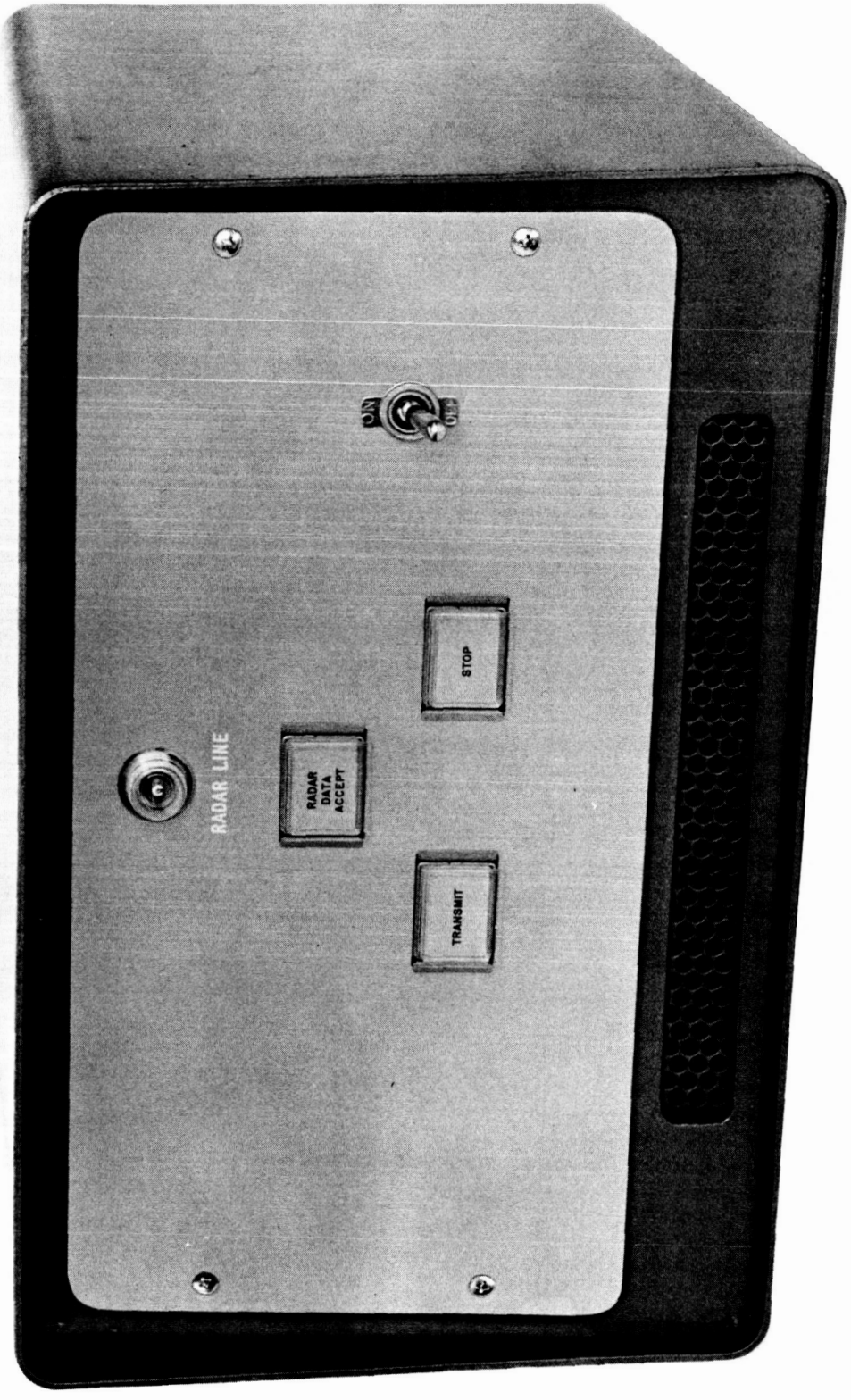


Figure 1-4. Radar Data Control Unit (Single)

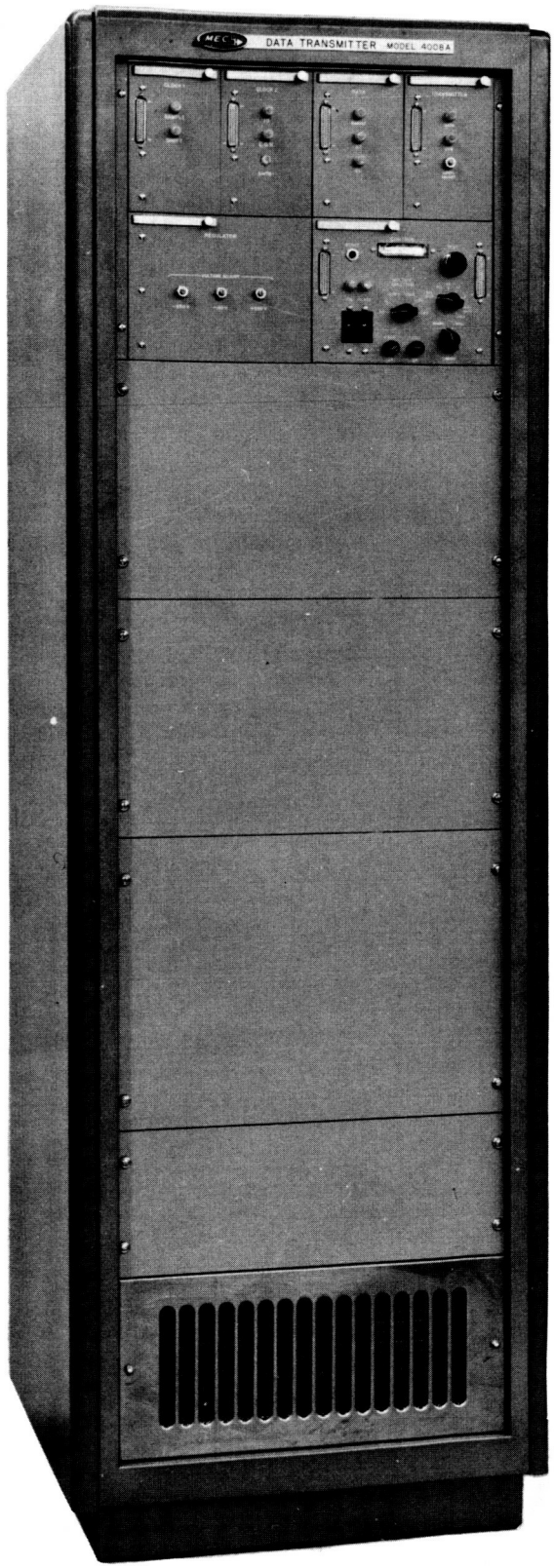


Figure 1-5. Data Transmitter (FPS-16)

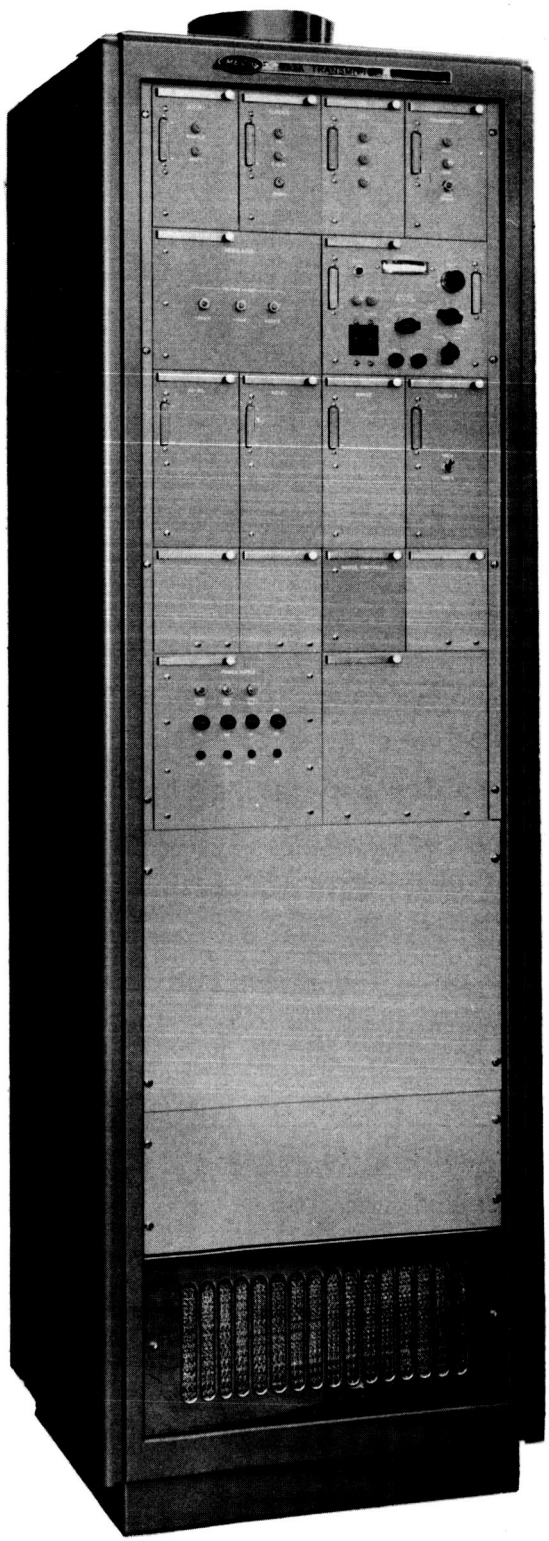


Figure 1-6. Data Transmitter (Verlort)

are accessible by removing a portion of the front panel located near the bottom of the cabinet. Power receptacles are provided at the rear of the cabinet, and a blower is installed in the bottom of the cabinet for positive pressure ventilation.

(2) FUNCTIONAL DESCRIPTION - The data transmitters accept digital data from FPS-16 and Verlort radars consisting of azimuth, elevation, and range information. The information is translated into tone-coded digital data suitable for high-speed transmission over voice quality lines. The information is time-identified by means of inputs from the site time generator.

E. DATA RECEIVER

(1) PHYSICAL DESCRIPTION - The 4008-2A (8-bit) and the 2008-2B (36-bit) data receivers (figures 1-7 and 1-8) are contained in 24 by 22 by 77-1/8-inch cabinets weighing approximately 500 pounds. All controls and indicators are contained on the front panels of the cabinets. Signal input and output cable connectors are accessible from the bottom of the front panel. Power receptacles are located at the rear of the cabinet. A blower is installed in the bottom of the cabinet for positive pressure ventilation.

(2) FUNCTIONAL DESCRIPTION - The 8-bit receivers accept high-speed, tone-coded digital signals from the two data transmitters at Bermuda. The information is arranged into the proper format which is acceptable to the IBM Data Communication Channel (DCC). The 36-bit receiver furnished at Cape Canaveral converts information from three radars into a format acceptable to the digital-to-teletype converter.

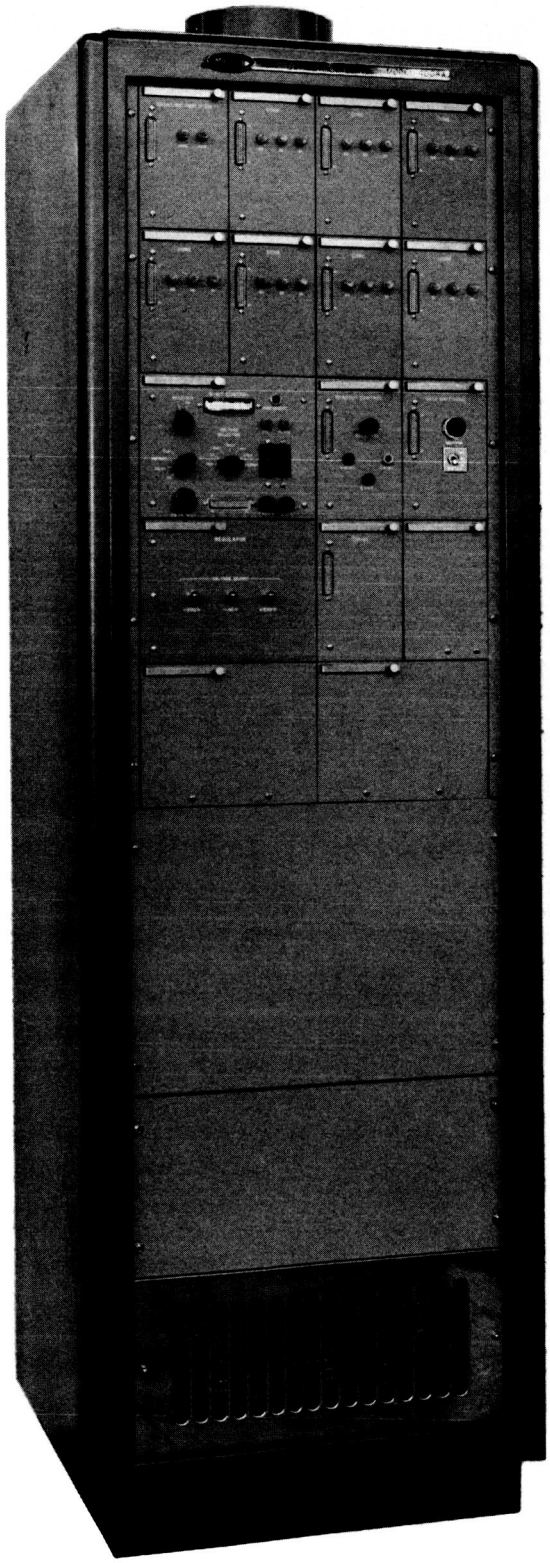


Figure 1-7. Data Receiver (8-Bit)

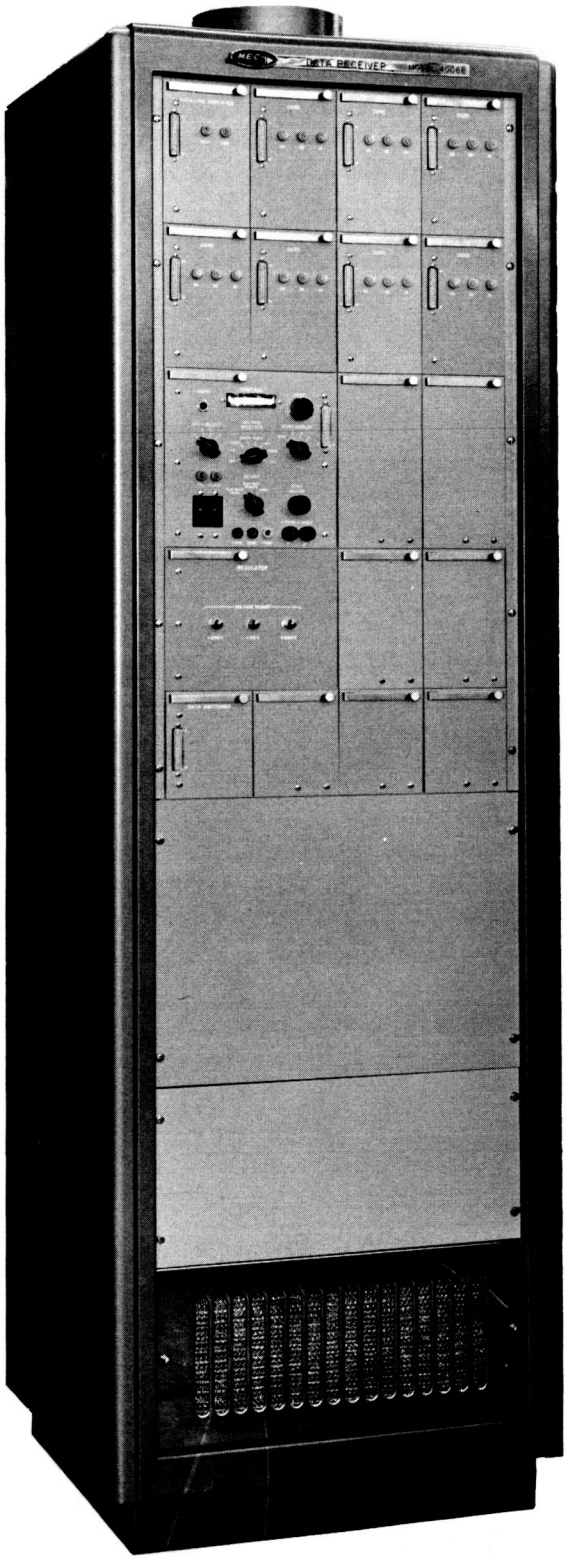


Figure 1-8. Data Receiver (36-Bit)

F. TELEMETRY/EVENT BUFFER

(1) PHYSICAL DESCRIPTION - The telemetry/event buffer (figure 1-9) furnished at the Bermuda installation contains one buffer unit, one power supply unit, a blower unit, and the necessary signal and power external cable connectors. The buffer and power supply units are slide-mounted in the 18-1/2 by 23-1/2 by 36-1/2-inch cabinet. The blower is mounted in the bottom of the cabinet by means of four cabinet mounting screws. Controls and indicators are located on the buffer unit test shelf and on the front panel of the power supply unit.

(2) FUNCTIONAL DESCRIPTION - The telemetry/event buffer accepts outputs from the Capsule Time Display and Control Cabinet and telemetering event display equipment. The information is then arranged into a format acceptable to the IBM Data Communication Channel (DCC). The data is transmitted to the DCC in response to pulses from the computing equipment.

G. TELEMETRY/EVENT TRANSMITTING BUFFER

(1) PHYSICAL DESCRIPTION - The telemetry/event transmitting buffer (figure 1-10) consists of two buffer units, two power supply units, and a blower installed in an 18-1/2 by 22 by 36-inch cabinet. Input and output cable connectors are installed at the rear of the cabinet. Controls and indicators are mounted on the test shelves of the buffer units and on the front panels of the power supply units. The blower is installed in the bottom of the cabinet by means of four panel mounting screws.

(2) FUNCTIONAL DESCRIPTION - The telemetry/event transmitting buffer accepts data in parallel from the Fine Monitor

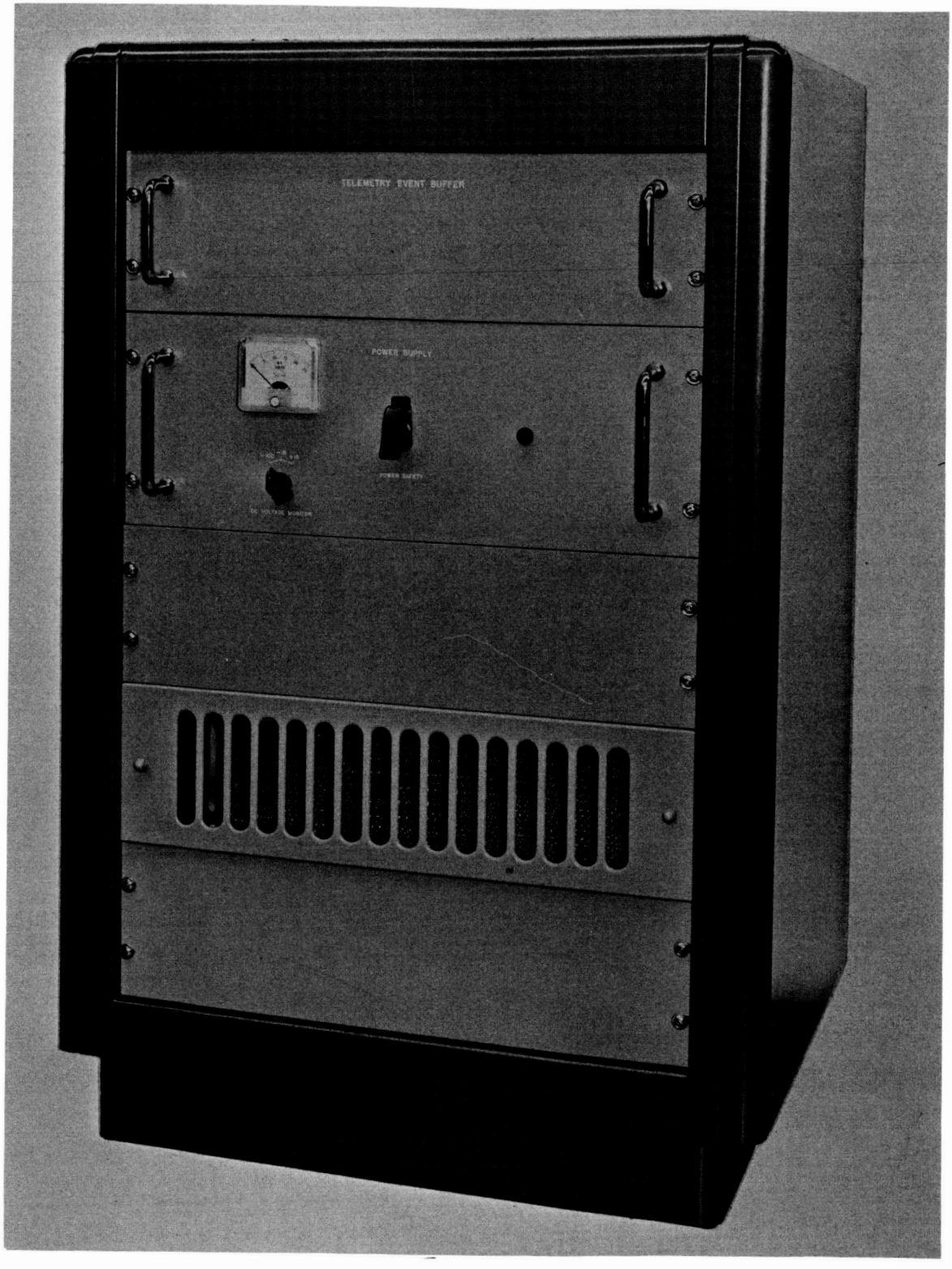


Figure 1-9. Telemetry/Event Buffer

Figure 1-10. Telemetry/Event Transmitting Buffer

Cabinet and telemetry event display equipment at Cape Canaveral. The information is arranged into the required format and retransmitted as tone bursts to high-speed data receiving equipment located in the G. E. - Burroughs and IP-709 buildings. A selector switch permits the transmission of information to the two buildings from either, or both, buffer units, and permits the buffer to be remotely controlled from a tape unit.

H. TAPE RECORDER/REPRODUCER

(1) PHYSICAL DESCRIPTION - The tape recorder/reproducer (figure 1-11) consists of one tape transport, three connecting chassis, and one blower unit. All components are contained in a 24 by 23 by 77-1/8-inch cabinet with the controls and indicators mounted on the front panel. External cable connectors are accessible from the rear of the cabinet. Record and reproduce speeds of 30, 15, 7-1/2, and 3-3/4 inches per second are provided.

(2) FUNCTIONAL DESCRIPTION - The 3-channel tape recorder is furnished at the Bermuda site to monitor all valid tracking information transmitted from the two data transmitters. Two of the channels are connected to data receivers with the third available as a spare. Because the tape recorder is connected as a monitor between the data transmitters and receivers, it is possible for the receivers to accept information directly from the data transmitters or to accept recorded information from the tape recorder.

J. RADAR TRANSFER SWITCH

(1) PHYSICAL DESCRIPTION - The radar transfer switch (figure 1-12) is mounted in a 14-1/2 by 4 by 3-3/4-inch cabinet suitable for wall-type mounting. Signal inputs are terminated at five coaxial

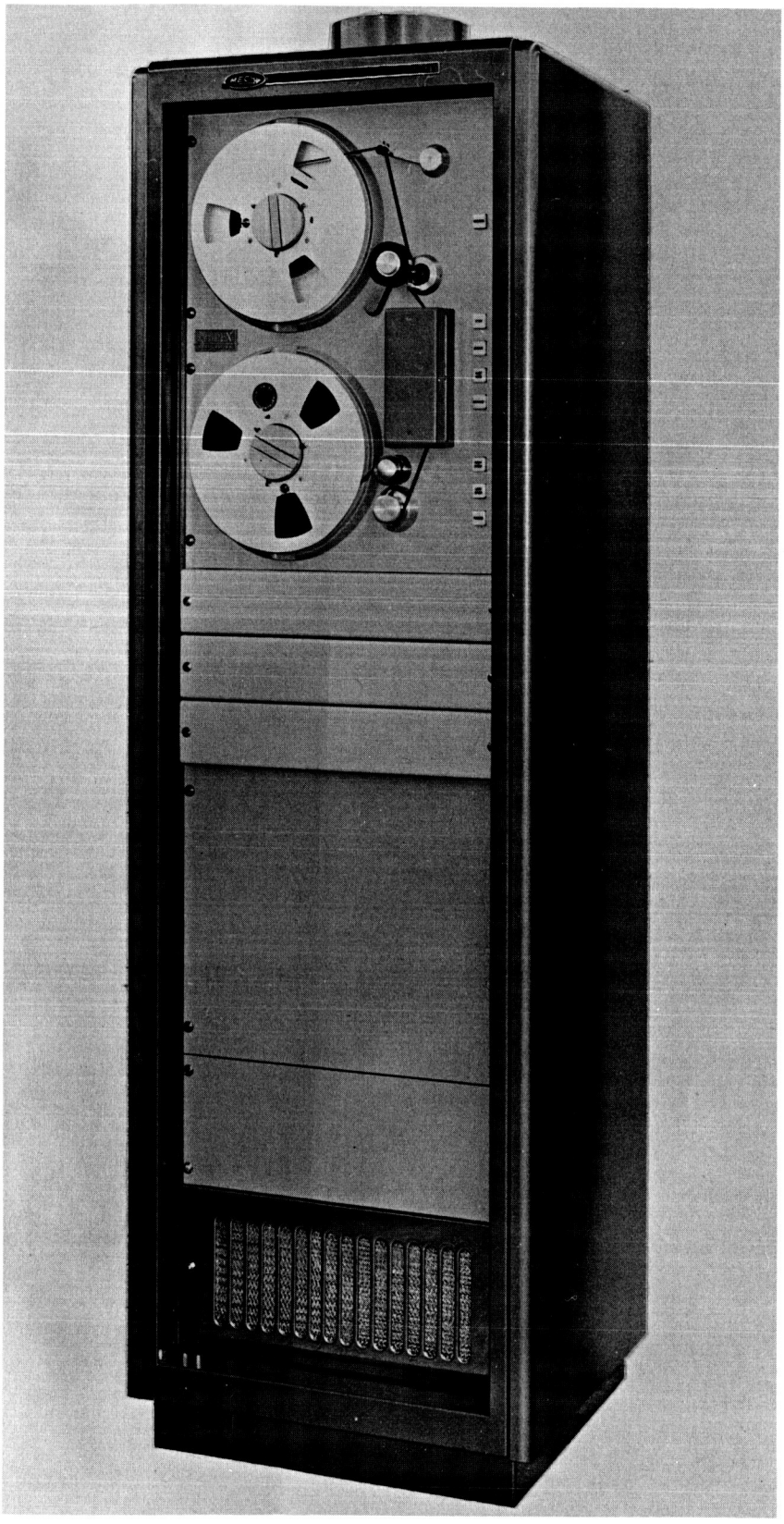


Figure 1-11. Tape Recorder/Reproducer

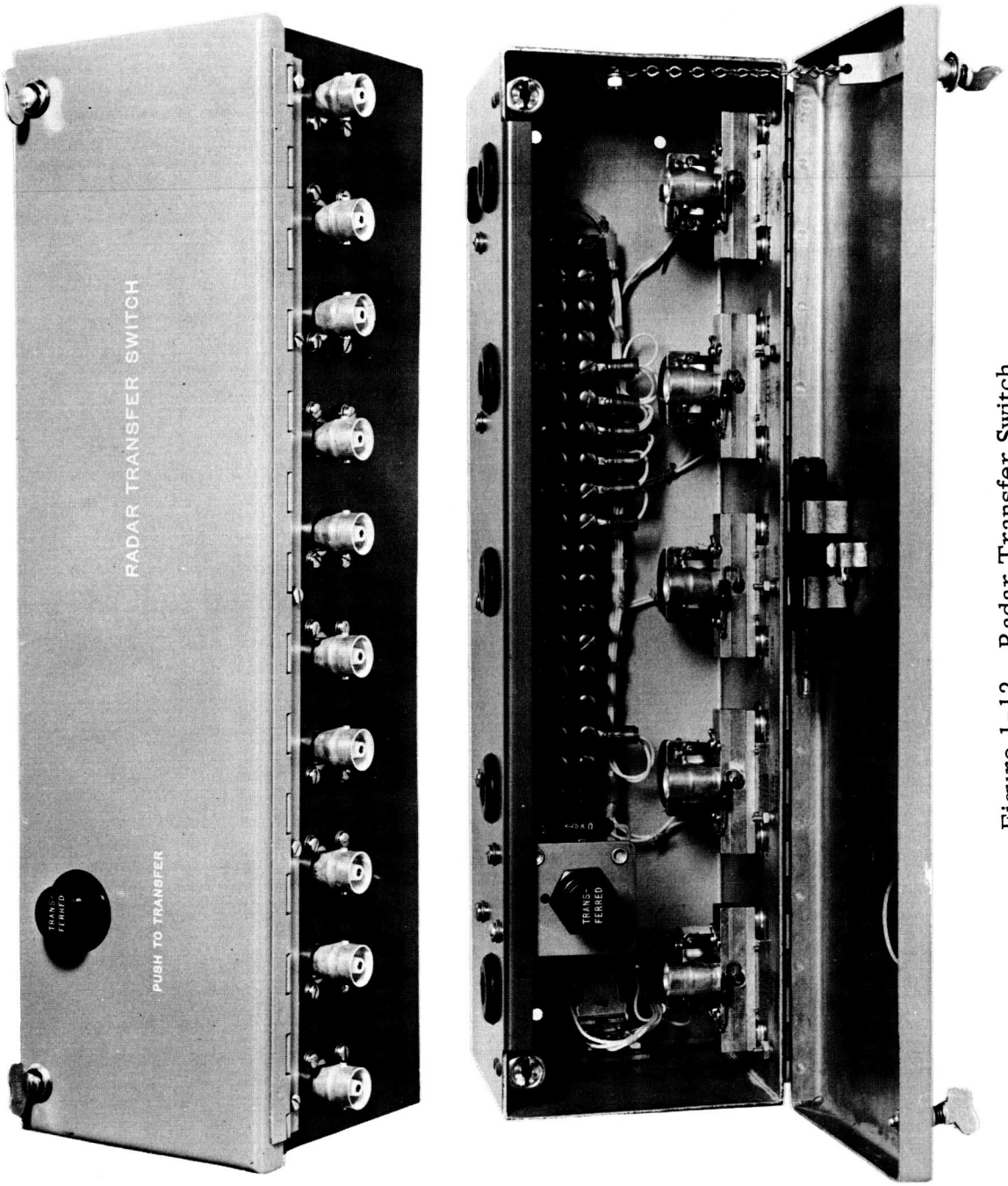


Figure 1-12. Radar Transfer Switch

relays. Ten coaxial output connectors are provided on the bottom of the cabinet. Five are accessible through holes in the top of the cabinet. A push-button switch/indicator is mounted inside the cabinet together with a terminal strip, the coaxial relays, and a 115 volt power relay. A bulb extractor and a spare lamp are mounted on the inside surface of the cabinet door.

(2) FUNCTIONAL DESCRIPTION - The purpose of the radar transfer switch is to transfer FPS-16 radar tracking data normally connected to data processing equipment existing at the ground instrumentation site to Project Mercury digital data processing equipment. The information consists of azimuth, range, elevation, read, and shift data.

The input and output cable terminal designations are printed on the chassis and are identified in figure 6-30. After the connections have been made, the switch may be checked for proper operation by depressing the TRANSFER push-button/indicator and observing the transfer of information at the data processing equipment. The TRANSFER push-button/indicator should illuminate red when data is connected to the Project Mercury equipment, and should not illuminate when data is connected to existing equipment.

1-4. SITE IMPLEMENTATION

A. GENERAL

The objective of Project Mercury involves the accomplishment of four mission time phases -- insertion, orbit, re-entry, and post flight analysis. Ground instrumentation sites participate in the mission according to prescribed individual site requirements which vary among the site categories. All sites furnished with digital data processing equipment utilize the digital-to-teletype conversion subsystem. The computing center and the computer, launch, and demonstration sites utilize high-speed data transmission subsystem equipment. Only the computer and launch sites employ the preparation of telemetry and time information subsystem equipment.

B. EQUIPMENT ALLOCATION

The Project Mercury digital data processing equipment allocation per site is presented in Table I-3.

C. SITE DESCRIPTIONS

(1) DUAL COMMAND SITES - Kauai Island, Hawaii and Point Arguello, California, (figure 6-4) are furnished with digital-to-teletype conversion equipment. Capsule tracking information from Verlort and FPS-16 radars is converted to start/stop teletype signals at the digital-to-teletype converters. The converters also receive time inputs from the site time generator. Time-identified teletype signals are then applied to a radar data control unit (dual) which selects either converted output for transmission to the teletype sending circuit.

TABLE I-3. DIGITAL DATA PROCESSING EQUIPMENT ALLOCATION PER SITE

	COMMAND		NON-COMMAND		COM-PUTER	LAUNCH	DEMON-STRATION
	DUAL	SINGLE	DUAL	SINGLE	DUAL	SINGLE	DUAL
	KAUAI ISLAND POINT ARGUELLO	MUCHEA GUAYMAS	EGLIN	GRAND CANARY ISLAND WOOMERA WHITE SANDS CORPUS CHRISTI	BER-MUDA	CAPE CANA-VERAL	WALLOPS ISLAND
Converter, Milgo 165	2	1	2	1	2	1	2
Radar Data Control Unit (Dual)	1		*1		1		1
Radar Data Control Unit (Single)		1		1		1	
Data Transmitter, Milgo 4008-1A					1		1
Data Transmitter, Milgo 4008-1B					1		
Data Receiver, Milgo 4008-2A					2		

*Special Eglin Unit

TABLE I-3. DIGITAL DATA PROCESSING EQUIPMENT ALLOCATION PER SITE (Continued)

	COMMAND		NON-COMMAND		COM-PUTER	LAUNCH	DEMON-STRATION
	DUAL	SINGLE	DUAL	SINGLE	DUAL	SINGLE	DUAL
	KAUAI ISLAND POINT ARGUELLO	MUCHEA GUAYMAS	EGLIN	GRAND CANARY ISLAND WOOMERA WHITE SANDS CORPUS CHRISTI	BER-MUDA	CAPE CANA-VERAL	WALLOPS ISLAND
Data Receiver, Milgo 4008-2B						1	
Telemetry/ Event Trans-mitting Buffer						1	
Telemetry/ Event Buffer					1		
Tape Recorder/ Reproducer					1		
Radar Trans-fer Switch	1		***1	1**			1

**Furnished at Woomera and White Sands only.
***Special Eglin Assembly

(2) SINGLE COMMAND SITES - Muchea, Australia and Guaymas, Mexico (figure 6-6) employ the digital-to-teletype conversion subsystem. A converter receives capsule tracking information from a Verlort radar and time inputs from the site time generator. Time-identified teletype signals are applied to a radar data control unit (single) which controls the transmission of information to the teletype circuit.

(3) DUAL NON-COMMAND SITE - Eglin receives tracking information from MPQ-31 and FPS-16 radars, converts the data to time-identified teletype signals at two digital-to-teletype converters, and applies the information to a special radar data control unit (dual). The Eglin unit differs from other dual units in that it provides control over secondary data transmission to Cape Canaveral in addition to the selection and control of two converter outputs for transmission to the normal teletype sending line.

(4) SINGLE NON-COMMAND SITES - Grand Canary, Woomera, White Sands, and Corpus Christi (figure 6-6) receive tracking information from either a Verlort or an FPS-16 radar. The data is converted to time-identified teletype signals at a digital-to-teletype converter and applied to a radar data control unit (single) for transmission, or no transmission, to the sending line.

(5) COMPUTER SITE - Bermuda (figure 6-2) is furnished with digital-to-teletype conversion subsystem equipment, high-speed data transmission equipment, and preparation of telemetry and time information subsystem equipment.

(a) DIGITAL-TO-TELETYPE CONVERSION - Two digital-to-teletype converters receive tracking

information from Verlort and FPS-16 radars. The information is converted to teletype signals and applied to a radar data control unit (dual) which controls the transmission of data from either converter to the teletype sending circuit.

(b) HIGH-SPEED DATA TRANSMISSION - At Bermuda, digital information from the Verlort and FPS-16 radars is also received at high-speed data transmitters. The data is translated into tone-coded digital signals and transmitted over voice quality lines to 8-bit data receivers. A tape recorder/reproducer monitors all valid tracking information from the data transmitters. The receivers convert the data to a format suitable for input to computing equipment. Time signals accepted by the data transmitters from the site time generator are also transmitted to the receivers.

(c) PREPARATION OF TELEMETRY AND TIME INFORMATION - A telemetry/event buffer arranges information from the capsule clock cabinet and event display equipment at the computer site into a format acceptable to the IBM Data Communication Channel(DCC). Information received by the buffer is applied to the IBM DCC in response to asynchronous pulses supplied from the computer.

(6) LAUNCH SITE - Cape Canaveral (figure 6-1) is furnished with digital-to-teletype conversion equipment, high-speed data transmission equipment, and preparation of telemetry and time information subsystem equipment.

(a) DIGITAL-TO-TELETYPE CONVERSION AND HIGH-SPEED DATA TRANSMISSION - Downrange radar tracking information is received by a 36-bit data receiver and applied to a digital-to-teletype converter. The information is converted to teletype signals and applied to a radar data control unit (single) which selects the tracking information for transmission, or no transmission, to the sending line.

(b) PREPARATION OF TELEMETRY AND TIME INFORMATION - A telemetry event transmitting buffer accepts data in parallel from telemetry event display and the Fine Monitor Cabinet at Cape Canaveral. The information is arranged into the proper format and serially transmitted to transmitting equipment in the G. E. -Burroughs and IP-709 buildings.

(7) DEMONSTRATION SITE - Wallops Island (figure 6-7) is furnished with the digital-to-teletype conversion equipment and the high-speed data transmission equipment necessary to illustrate the operation of these two subsystems in the digital data processing system.

(a) DIGITAL-TO-TELETYPE CONVERSION - The outputs of two converters are connected to a radar data control unit (dual) which selects and controls transmission, or no transmission, of time-identified teletype information to the sending side of the full duplex teletype circuit.

(b) HIGH-SPEED DATA TRANSMISSION - A data transmitter at Wallops Island receives information from an FPS-16 radar. The information is translated into data

suitable for transmission to a data receiver at the Space Flight Center. The information is time-identified at the data transmitter by means of inputs from the site time generator.

SECTION II
INSTALLATION

2-1. GENERAL

This section contains information pertaining to installation of the digital data processing equipment furnished to the Project Mercury ground instrumentation sites. Included are diagrams of radar buildings and vans, and the telemetry control buildings and rooms which contain digital data processing equipment. Additional installation information includes inspection, unpacking, and cable installation instructions.

Reference to the individual site block and wiring diagrams contained in section VI of this handbook will provide detailed equipment termination and interconnecting cable information to facilitate installation procedures.

2-2. RADAR VAN AND BUILDING LAYOUTS

A. VERLORT RADAR VANS

The ground instrumentation sites furnished with Verlort radar vans are listed in Table II-1. Digital data processing and associated equipment installed in the vans (figure 2-1) consists of a Verlort digital-to-teletype converter and a 28 RO teletype page printer. The Verlort van at Bermuda also contains a high-speed data transmitter.

TABLE II-1. SITE RADAR VAN AND BUILDING FACILITIES

SITE	FPS-16 BUILDING	VERLORT VAN	MPQ-31 (IN FPS-16 BUILDING)
Bermuda	X	X	
Grand Canary Island		X	
Muchea, Australia		X	
Woomera, Australia	X		
Kauai Island, Hawaii	X	X	
Point Arguello, California	X	X	
Guaymas, Mexico		X	
White Sands, New Mexico	X		
Corpus Christi, Texas		X	
Eglin, Florida	X		X
Wallops Island	X		

B. FPS-16 RADAR BUILDINGS

The ground instrumentation sites employing FPS-16 radar buildings are listed in Table II-1. The FPS-16 building layouts, differing at the various sites, are described separately in the following paragraphs.

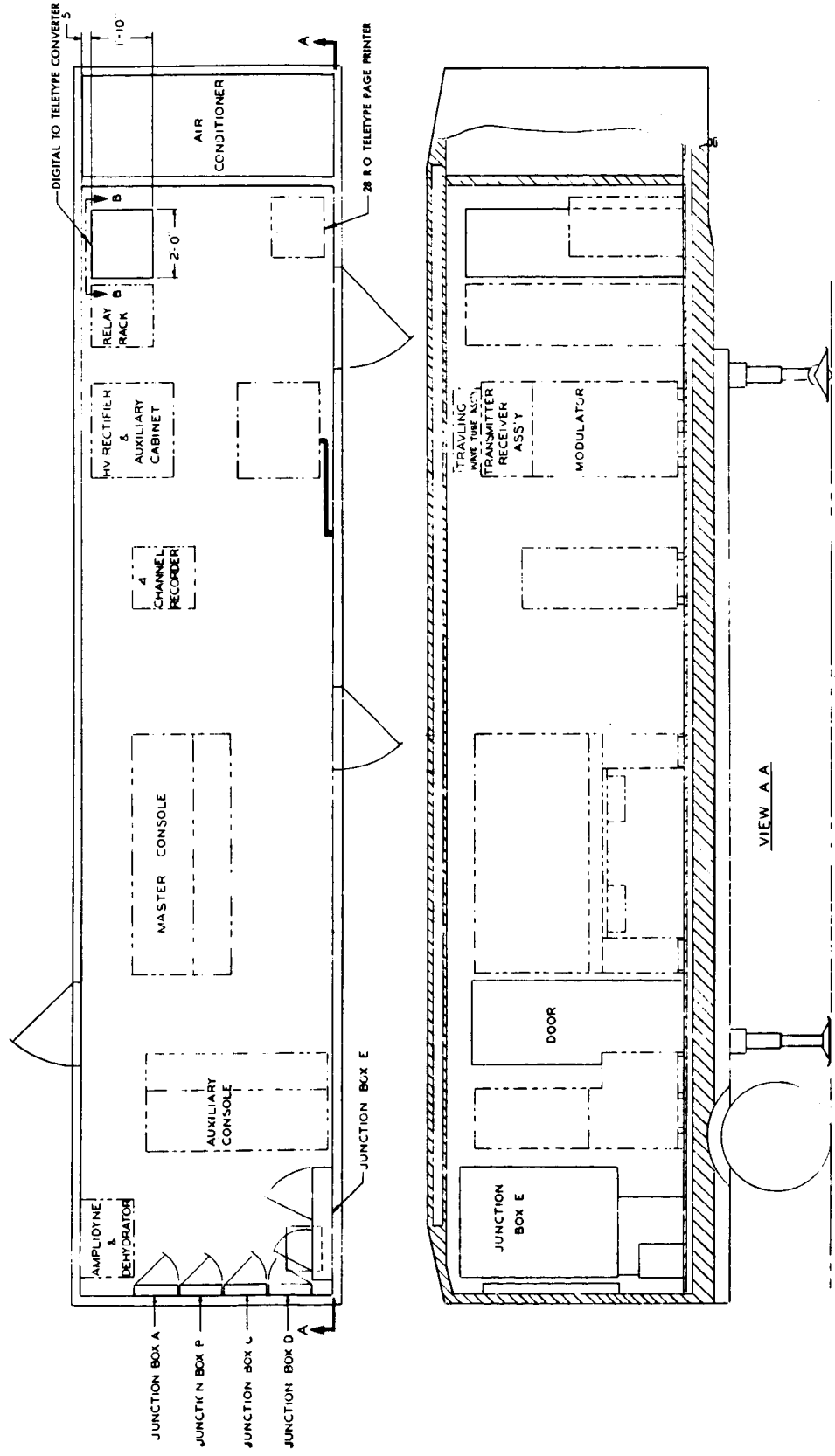


Figure 2-1. Verlort Radar Van - Layout Diagram

(1) BERMUDA AND WALLOPS ISLAND - The FPS-16 buildings at Bermuda (figure 2-2) and Wallops Island (figure 2-3) are furnished with a high-speed data transmitter, a digital-to-teletype converter, a 28 RO page printer, and a radar transfer switch.

(2) POINT ARGUELLO AND KAUAI - The digital data processing equipment installed in the FPS-16 buildings at Point Arguello and Kauai (figure 2-4) consists of a digital-to-teletype converter with an associated 28 RO page printer, and a radar transfer switch.

(3) WHITE SANDS - The White Sands FPS-16 radar building (figure 2-5) contains a digital-to-teletype converter, a 28 RO page printer, and a radar transfer switch.

2-3. BERMUDA COMPUTER ROOM (COOPER'S ISLAND)

Digital data processing equipment included in the computer room at Cooper's Island, Bermuda (figure 2-6) consists of two high-speed data receivers, a tape recorder/reproducer, and a telemetry/event buffer.

2-4. CAPE CANAVERAL TEL-3 BUILDING

Equipment comprising the three digital data processing subsystems is contained in the Tel-3 building at Cape Canaveral (figure 2-7). Included are a digital-to-teletype converter and its associated 28 RO teletype page printer, a high-speed data receiver (36-bit), and a telemetry/event transmitting buffer.

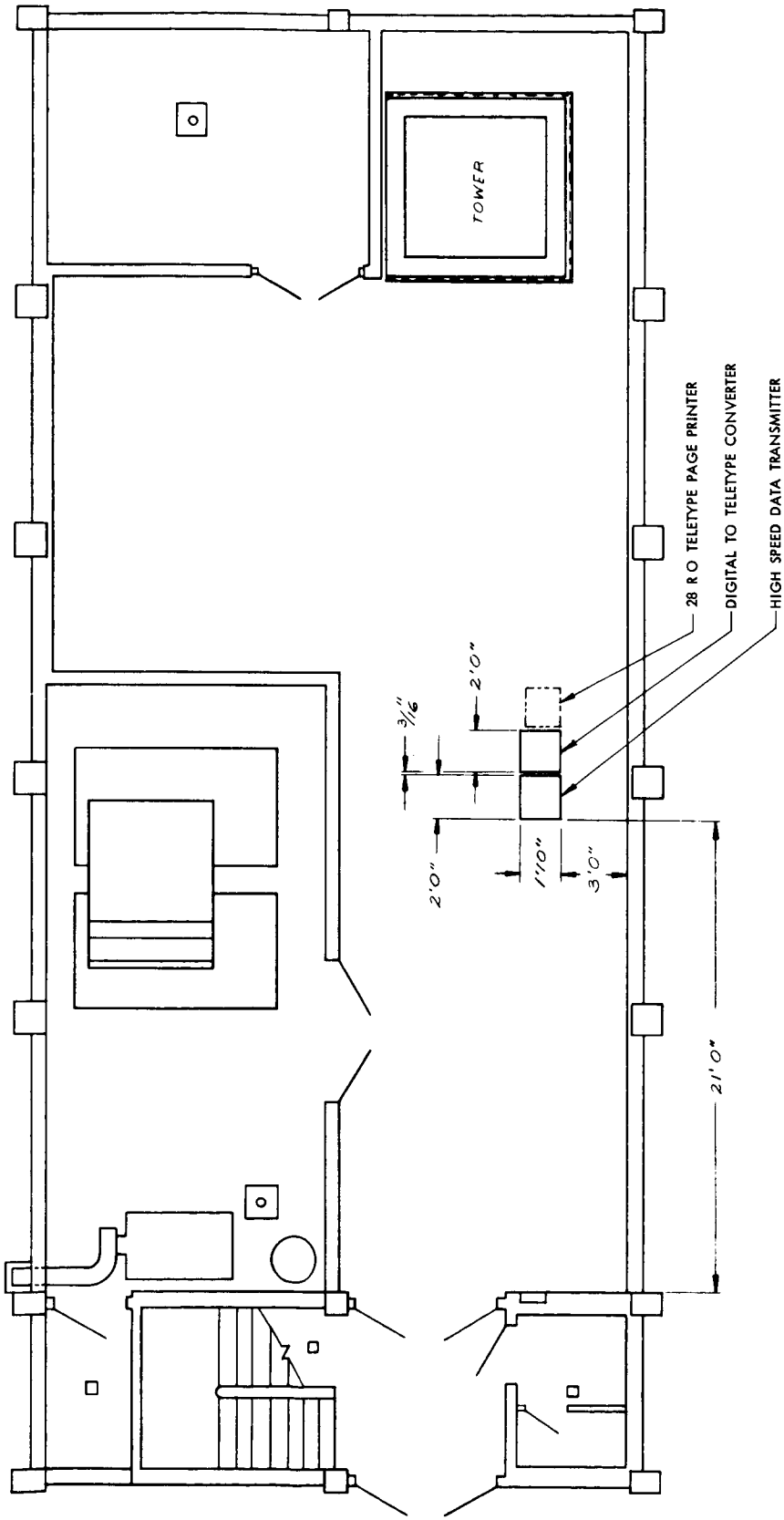


Figure 2-2. Bermuda FPS-16 Radar Building - Layout Diagram

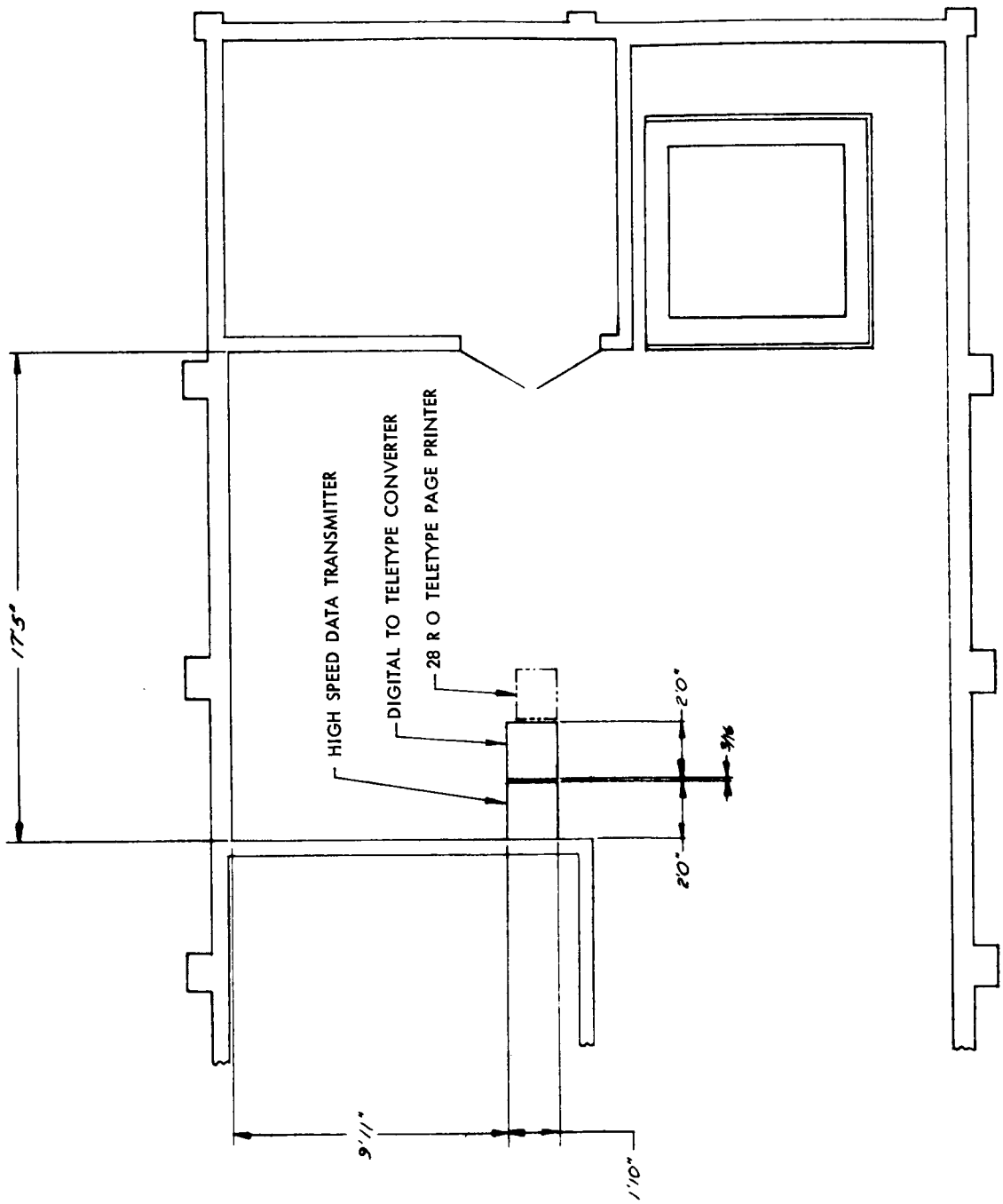


Figure 2-3. Wallops Island FPS-16 Radar Building - Layout Diagram

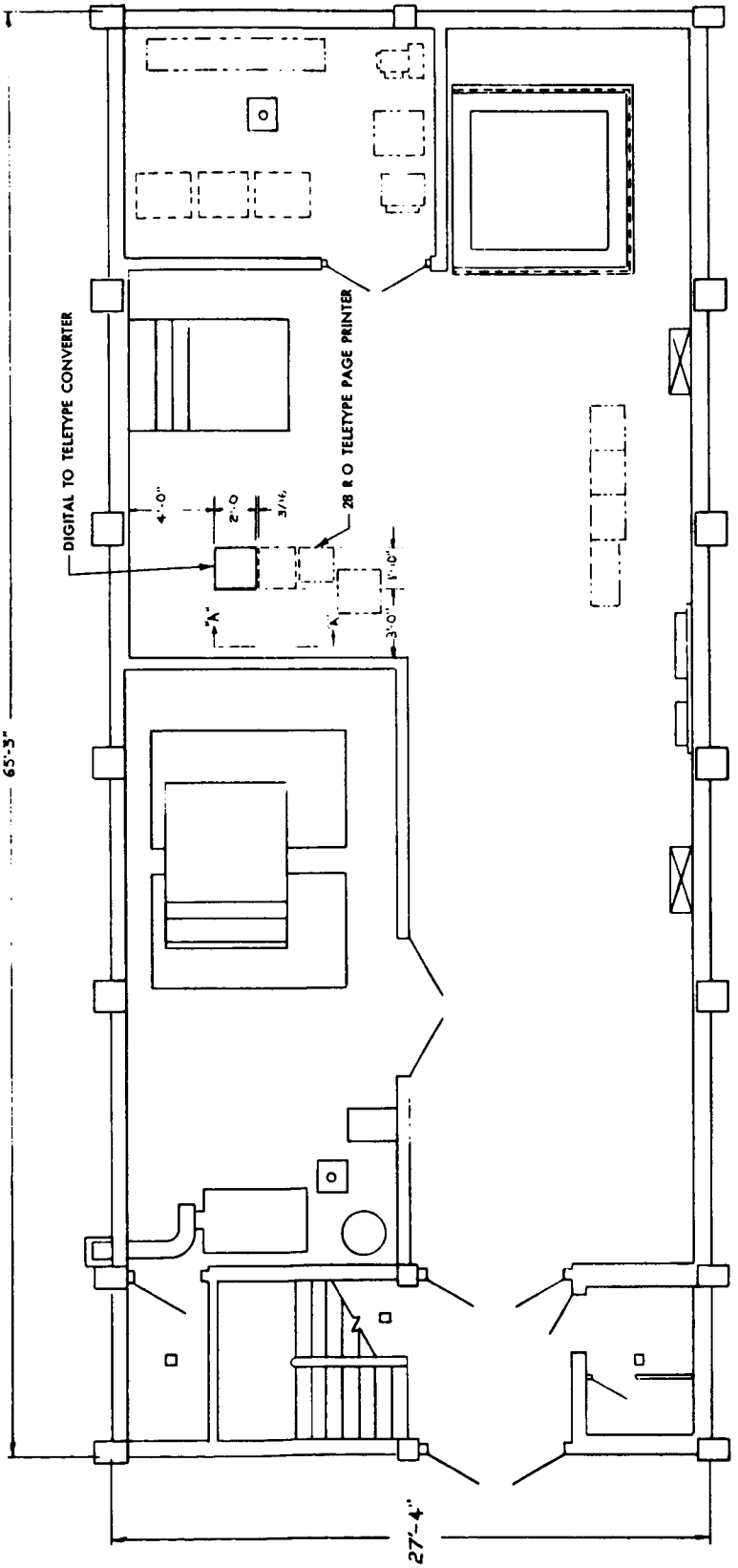


Figure 2-4. Point Arguello and Kauai FPS-16 Radar Building - Layout Diagram

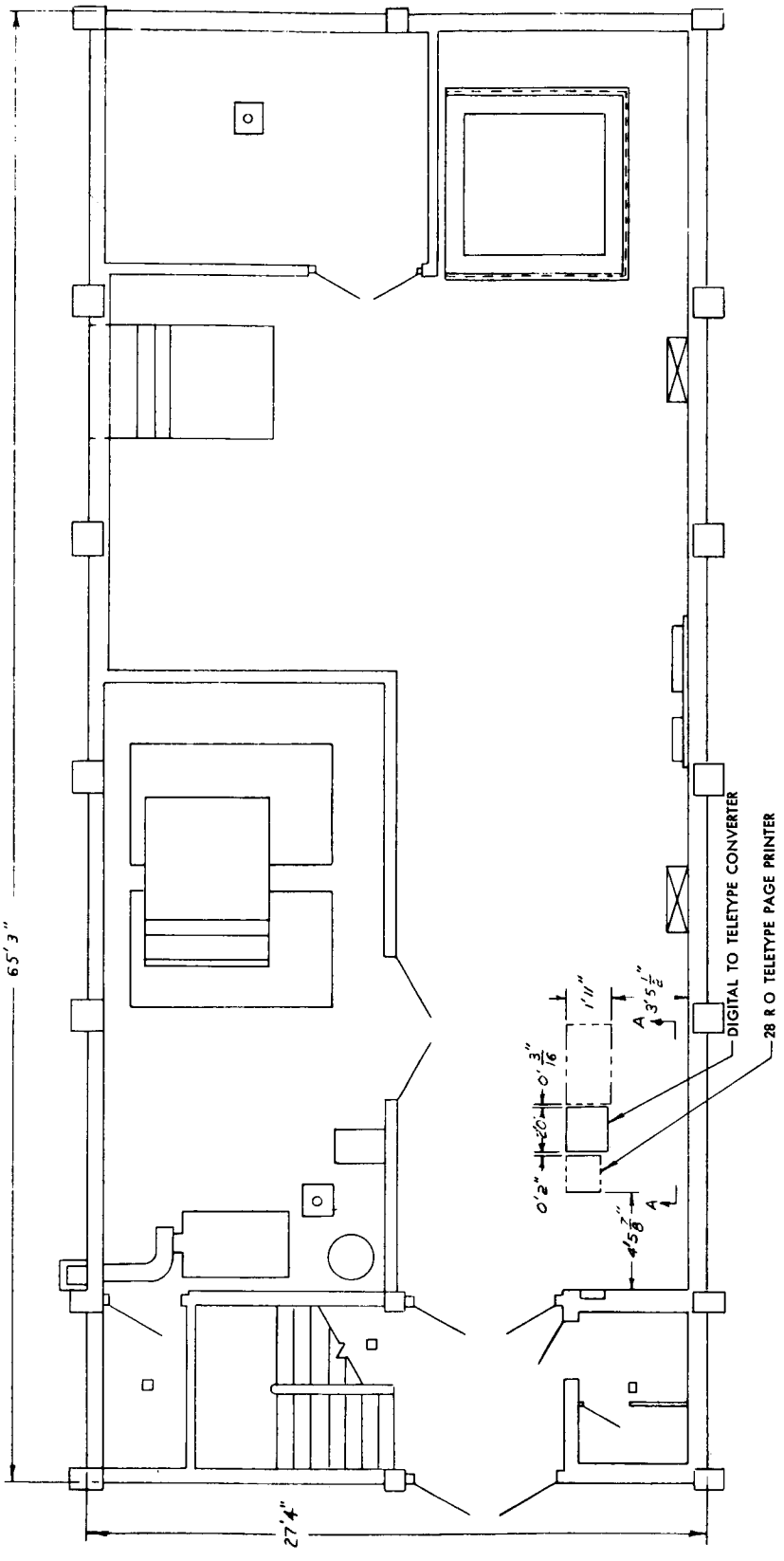


Figure 2-5. White Sands FPS-16 Radar Building - Layout Diagram

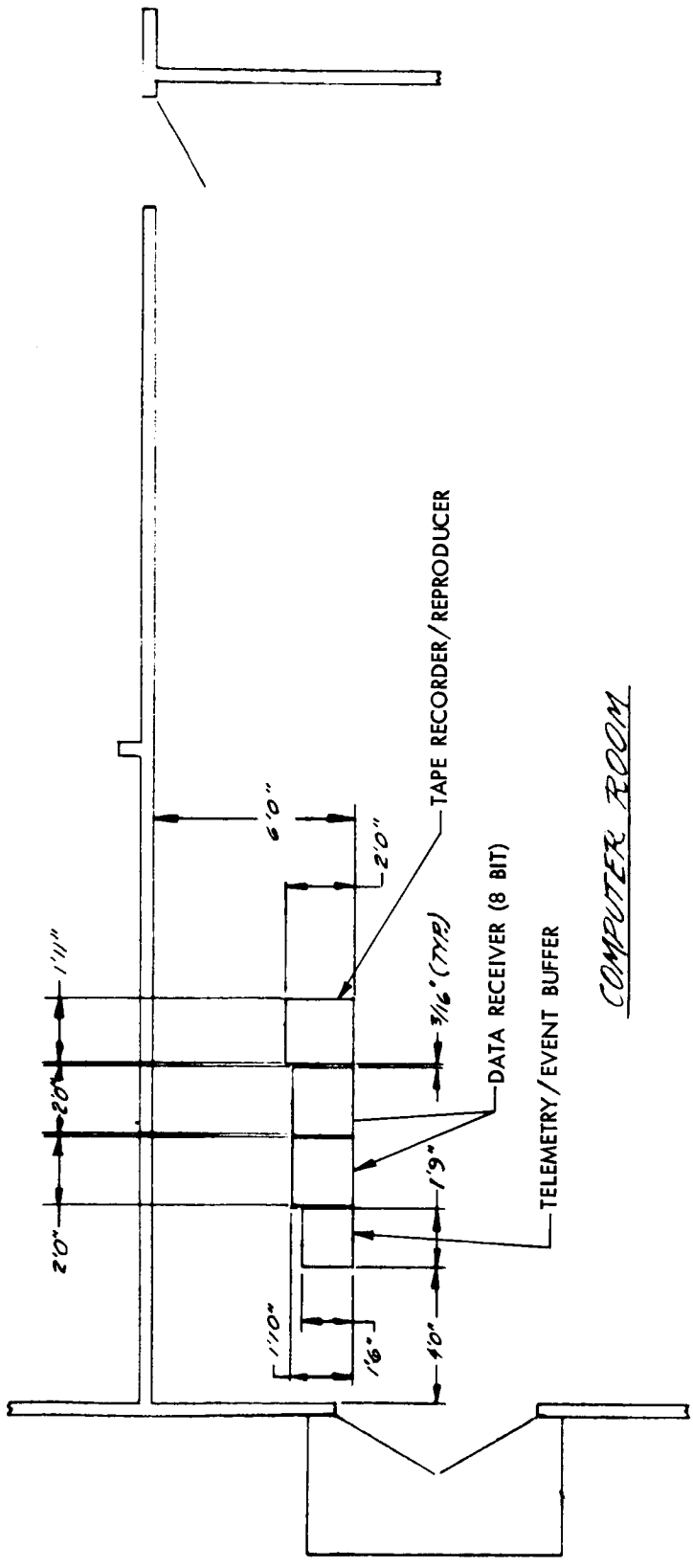


Figure 2-6. Bermuda Computer Room - Layout Diagram

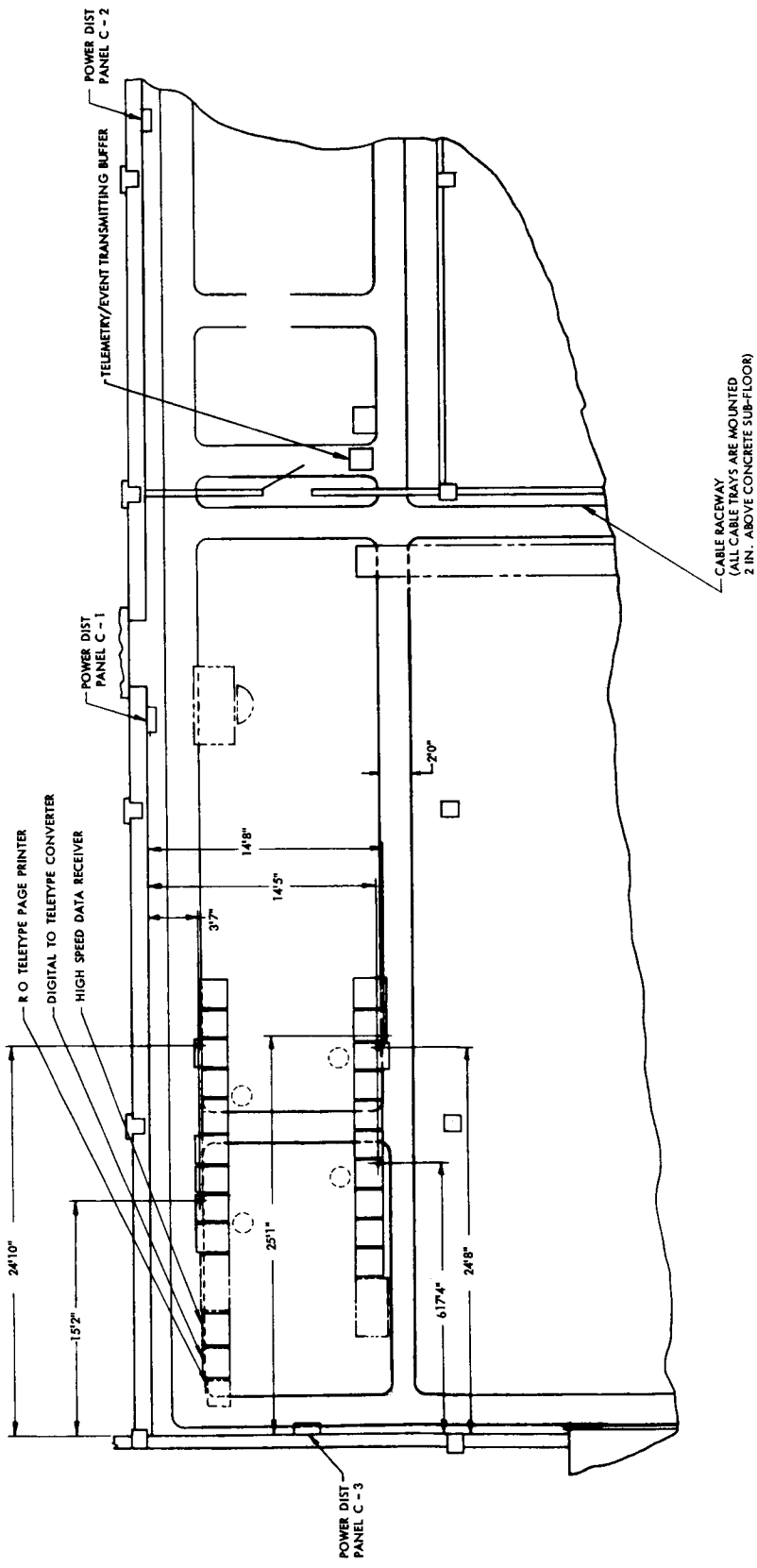


Figure 2-7. Cape Canaveral Tel-3 Building - Layout Diagram

2-5. WALLOPS ISLAND (DEMONSTRATION SITE)

Digital data processing equipment furnished at the control and telemetry room (figure 2-8) at Wallops Island consists of a digital-to-teletype converter with an associated 28 RO teletype page printer and a radar transfer switch.

2-6. UNIT INSTALLATION

A. GENERAL

The various items of equipment comprising the digital data processing system are shipped as individual units to be installed according to the required facilities provided at the ground instrumentation sites. Installation of the equiment involves inspection, unpacking, and installation of interconnecting cabling.

B. INSPECTION

Before unpacking the units, the shipping crates should be carefully examined for signs of damage. Any damage noted should be reported immediately in accordance with current directives.

C. UNPACKING

The following general procedure should be followed to remove the shipping crates from the units of equipment.

(1) Position the crate with the TOP up.

(2) Remove and retain the packing list.

(3) Dismantle and remove the crate.

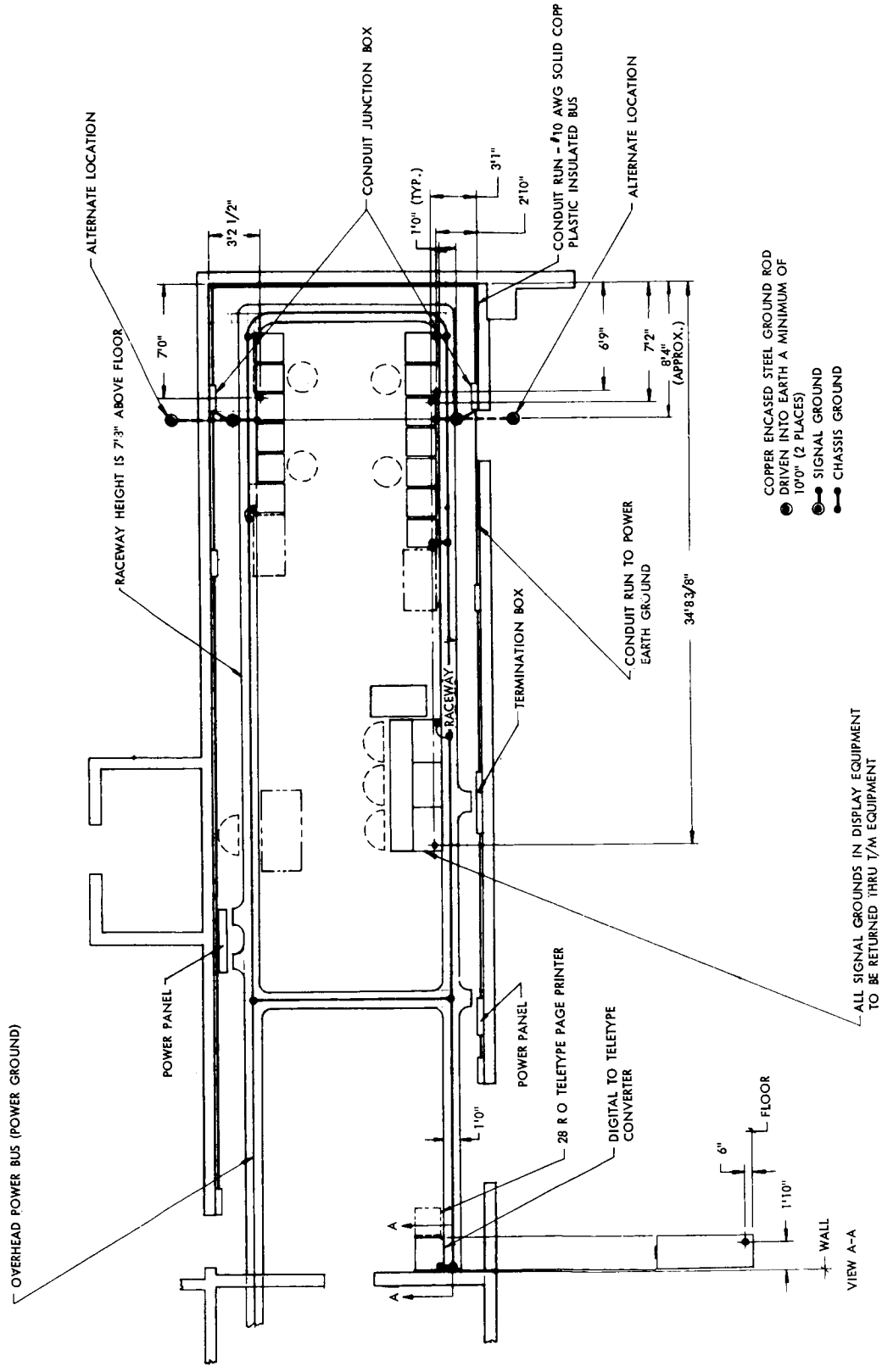


Figure 2-8. Wallops Island Control and Telemetry Room - Layout Diagram

CAUTION

Do not use pry bars or sharp instruments for removing the crate to avoid possible damage to the contents.

(4) Remove shipping tape from all cabinets and chassis.

(5) Remove panel mounting screws from all slide or rail mounted chassis.

(6) Beginning with the top panel, remove any packing material contained in the chassis.

(7) Slide each chassis back into place and install mounting screws securely.

2-7. CABLE INSTALLATION

Cable input and output connector designations for the items of equipment at each site are contained in the applicable wiring and interconnecting cable diagrams in Section VI of this handbook.

TABLE II-2. SITE DIAGRAM FIGURE NUMBERS

SITE	BLOCK DIAGRAM	INTERCONNECTING CABLE DIAGRAM	WIRING DIAGRAM
Cape Canaveral	6-1	6-8	6-18, 6-19
Bermuda	6-2	6-9	6-20, 6-21, 6-22
Eglin	6-3	6-10	6-23
Kauai	6-4	6-11	6-24
Point Arguello	6-4	6-12	6-24
Woomera	6-5	6-13	6-25
White Sands	6-5	6-14	6-26
Grand Canary Island	6-6	6-15	6-27
Muchea	6-6	6-16	6-28
Guaymas	6-6	6-16	6-28
Corpus Christi	6-6	6-15	6-27
Wallops Island	6-7	6-17	6-29

SECTION III

SYSTEM OPERATION

3-1. GENERAL

This section contains operating instructions for the Project Mercury digital data processing system. System operation includes operating procedures for the three digital data processing subsystems: digital-to-teletype conversion, high-speed data transmission, and preparation of telemetry and time information. The following paragraphs contain separate operating instructions for the three subsystems consisting of initial turn-on procedures, calibration and adjustment procedures, and normal and emergency operation procedures. The digital data processing system layout is presented in figure 3-1.

3-2. DIGITAL-TO-TELETYPE CONVERSION

A. GENERAL

Personnel requirements for operation of the digital-to-teletype conversion subsystem include a converter operator, a radar operator, and a teletype operator. The converter operator performs initial turn-on procedures and stand-by operational checks for the digital-to-teletype converters. The radar operator is responsible for initiating data acceptable indications for the tracking radars. The primary responsibilities of the teletype operator in the operation of the

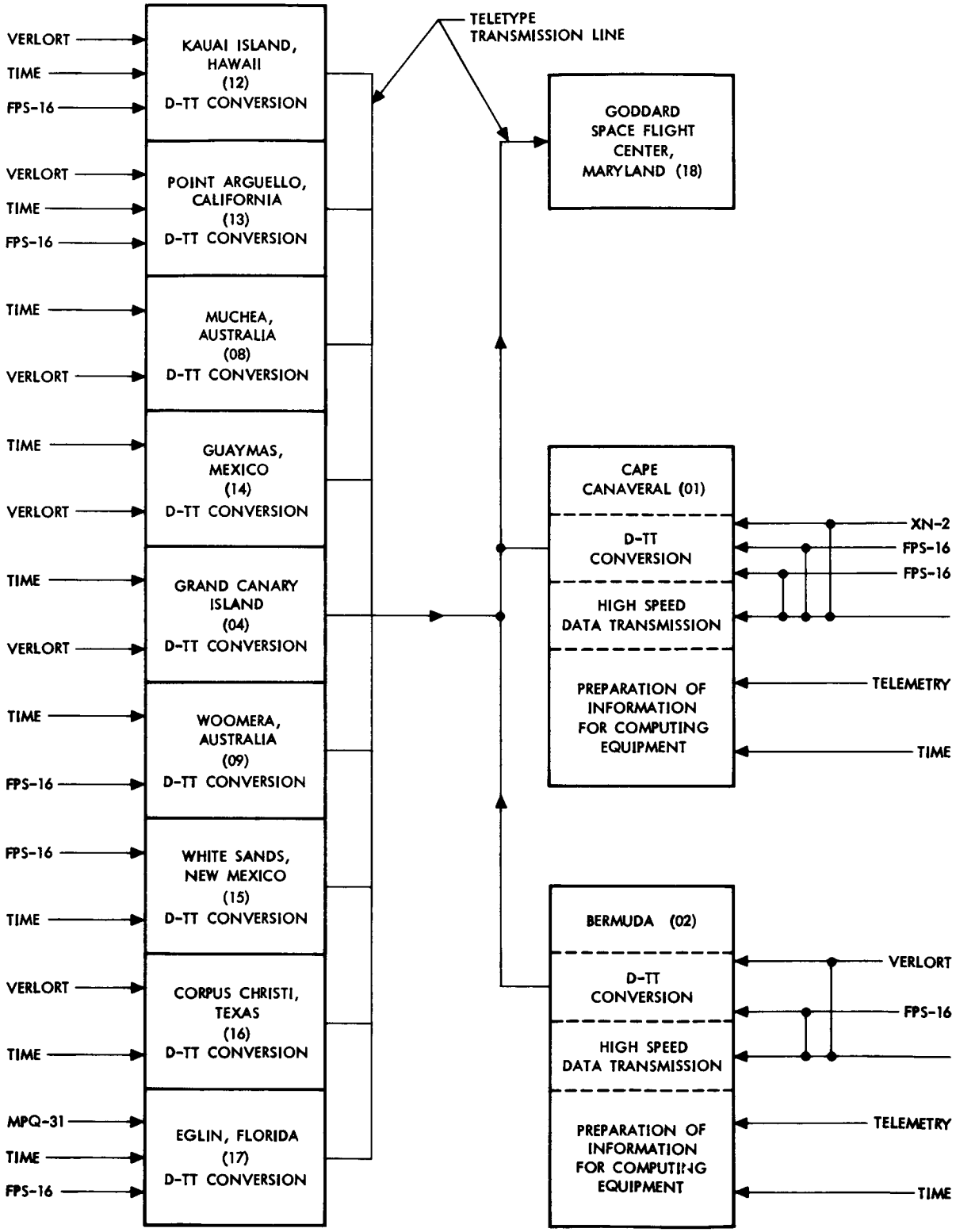


Figure 3-1. Project Mercury Digital Data Processing System Layout

digital data processing system are to control the start and stop of teletype transmission to the sending line and to select outputs from Verlort or FPS-16 radars at the radar data control unit.

All teletype tracking information transmitted to the Goddard Space Flight Center from the ground instrumentation sites is preceded with heading information. This information consists of 11 characters which serve to identify the message as to type of data, station identification, type of radar, and time of day (see Table III-2). The station identification numbers appear under the site names in figure 3-1.

B. INITIAL TURN-ON PROCEDURES

(1) GENERAL - To prepare the digital to teletype conversion subsystem for proper, efficient operation, a pre-operational test procedure and the necessary adjustment procedures must first be performed. The subsystem controls and indicators are illustrated in figures 3-2 and 3-3, and described in Table III-3.

(2) PRE-OPERATIONAL TEST - The step-by-step procedure comprising Table III-1 should be performed before each test or active subsystem operation. Included are tabulations of equipment, the procedural steps, and normal indications. If an abnormal indication is observed during any stage of the test, corrective action is required in accordance with the maintenance instructions contained in Section V of this handbook or the applicable equipment handbook referenced in Table 1-2.

NOTE

The test procedure outlines the steps necessary to check-out a dual site. By omitting the Verlort or FPS-16 steps of the procedure, the test will apply to single sites.

(3) ADJUSTMENTS - The following adjustment procedure should be performed to insure that the proper digital-to-teletype converter power requirements are furnished.

(a) Turn POWER switch to the ON position.

(b) Position Voltage switch to +12.

(c) Adjust +12 ADJ control so that 10 ±0. 5 is read on CONTROL meter.

NOTE

The CONTROL meter presents voltage readings in the form of percentages with 10 representing 100% of the measured voltage.

(d) Perform steps (b) and (c) for -20V and -70V adjustments.

NOTE

The -70V supply is derived from the -20V supply and a -50V supply and must therefore be adjusted in the sequence outlined.

(e) Return Voltage switch to the +12V position for monitoring operation.

TABLE III-1. DIGITAL-TO-TELETYPE CONVERSION SUBSYSTEM PRE-OPERATIONAL TEST PROCEDURE

EQUIPMENT	STEP	PROCEDURE	NORMAL INDICATION
Digital-to Teletype Converter (Verlort)	1	Turn POWER switch ON.	POWER indicator illuminates red.
	2	Turn TTY1 switch ON	
	3	Position Voltage switch to AC, +12V, -20V, and -70V.	CONTROL meter reads 10 for each position.
	4	Return Voltage switch to +12V.	CONTROL meter reads 10.
	5	Position Test Mode switch to PATT. A.	TEST mode indicator illuminates.
	6	Depress START button.	Verlort test pattern A (Table III-2) is read on 28 RO.
	7	Position Test Mode switch to PATT. B.	Verlort test pattern B (Table III-2) is read on 28 RO.

TABLE III-1. DIGITAL-TO-TELETYPE CONVERSION SUBSYSTEM PRE-OPERATIONAL TEST PROCEDURE (Continued)

EQUIPMENT	STEP	PROCEDURE	NORMAL INDICATION
Digital-to-Teletype Converter (FPS-16) (Continued)	8	Depress STOP button.	Last line is read on 28 RO.
	9	Depress OPERATE button.	Several lines are printed on 28 RO and TEST mode indicator is extinguished.
	10	Perform steps 1 through 9 for FPS-16 converter.	FPS-16 test patterns are read on 28 RO (see Table III-2)
Radar Data Control Unit	11	Turn ON/OFF switch ON and depress STOP control/indicator.	STOP indicator screen illuminates red.
	12	Depress VERLORT select control/ indicator.	VERLORT indicator screen illuminates white.
	13	Depress TRANSMIT control/indicator.	(a). TRANSMIT indicator screen illuminates yellow then, after a 6-second delay, green. (b). Both converters transmit 1-second address followed immediately by 6-second data frames. Both LINE indicators flash. Verlort data is sent to the line.

TABLE III-1. DIGITAL-TO-TELETYPE CONVERSION SUBSYSTEM PRE-OPERATIONAL TEST PROCEDURE (Continued)

EQUIPMENT	STEP	PROCEDURE	NORMAL INDICATION
Radar Data Control Unit (Continued)	14	Depress FPS-16 select control/ indicator.	(a). VERLORT indicator screen is extinguished and FPS-16 indicator screen illuminates yellow. (b). After last Verlort data frame is completed, the FPS-16 indicator screen illuminates white.
	15		(c). FPS-16 data is sent to the line.
	15	Depress STOP control/indicator.	(a). Green illumination of TRANSMIT indicator screen is extinguished and STOP indicator screen illuminates yellow - 6 to 12 seconds. (b). After last data frame and end of message sequence are transmitted, the STOP indicator screen illuminates red and the converters are released from the line.

TABLE III-2. DIGITAL-TO-TELETYPE CONVERTER TEST PATTERNS

CONVERTER TEST/OPERATE MODE	DATA FRAME - 34 TELETYPE CHARACTERS				
	BEGINNING OF MESSAGE SEQUENCE	TIME	AZI-MUTH	ELEVA-TION	RANGE
Verlort Test Pattern A	<≡ ↑ 3ΔΔ□0	!93759	3!463!	3!463!	063!463/
Verlort Test Pattern B	<≡ ↑ 3ΔΔ□2	264826	!463!4	!463!4	!463!46/
Operate	<≡ ↑ 2ΔΔ□⍟	xxxxxx	xxxxxx	xxxxxx	xxxxxxx/
FPS-16 Test Pattern A	<≡ ↑ 3ΔΔ□0	!93759	000000	000000	0000000/
FPS-16 Test Pattern B	<≡ ↑ 3ΔΔ□2	264862	377777	377777	3777777/
Operate	<≡ ↑ 2ΔΔ□⍟	xxxxxx	xxxxxx	xxxxxx	xxxxxxx/
4008R Test Pattern A	<≡ ↑ 3ΔΔ□0	!93759	252525	252525	2525252/
4008R Test Pattern B	<≡ ↑ 3ΔΔ□2	264826	!25252	!25252	!252525/

< Carriage Return

≡ Line Feed

↑ Figures

ΔΔ = Station Number

□ = Type of Radar

0 = FPS-16

Type of Data		
2 =	Real Radar Data	
3 =	Simulated (Test) Data	
7 =	Last Data Word	
0	Significance to be assigned by IBM.	
1		
4		
5		
6		
8		
9		

2	=	Verlort
3-9	=	Other Types
⏀	=	Data Validity
0	=	Unacceptable
2	=	Acceptable
JJ↓<≡↓	=	Start Code
∫∫↑L↓	=	Stop Code

NOTE: Arabic numeral one (1) appears as an exclamation point (!) in teletype data.

C. OPERATION

(1) NORMAL OPERATION - After all preliminary tests and adjustments have been performed, the converter may be put into normal operation by depressing the OPERATE button. Normal operation of the Radar Data Control Unit consists of positioning the ON/OFF switch to ON and depressing the TRANSMIT control/indicator.

At dual sites, data will be transmitted to the transmission line from either converter, depending upon which selection control/indicator (VERLORT or FPS-16) is activated.

Normal operation at single sites is identical to dual sites except for transmission of data which is controlled at a Radar Data Control Unit (single) from one radar only.

(2) EMERGENCY OPERATION - If, during an operational mission, the external range time supplied to the converter is not functioning properly, valid tracking information may be transmitted by adapting the converter to the test mode of operation. This procedure is accomplished by depressing the TEST button, positioning the TEST MODE function switch to DATA and the TIME switch to INT., and depressing the START button. Information will then be transmitted without the externally supplied time data, but with local timing supplied from the converter. With either converter set up in this manner, neither will be under control of the Radar Data Control Unit.

D. CONTROLS AND INDICATORS

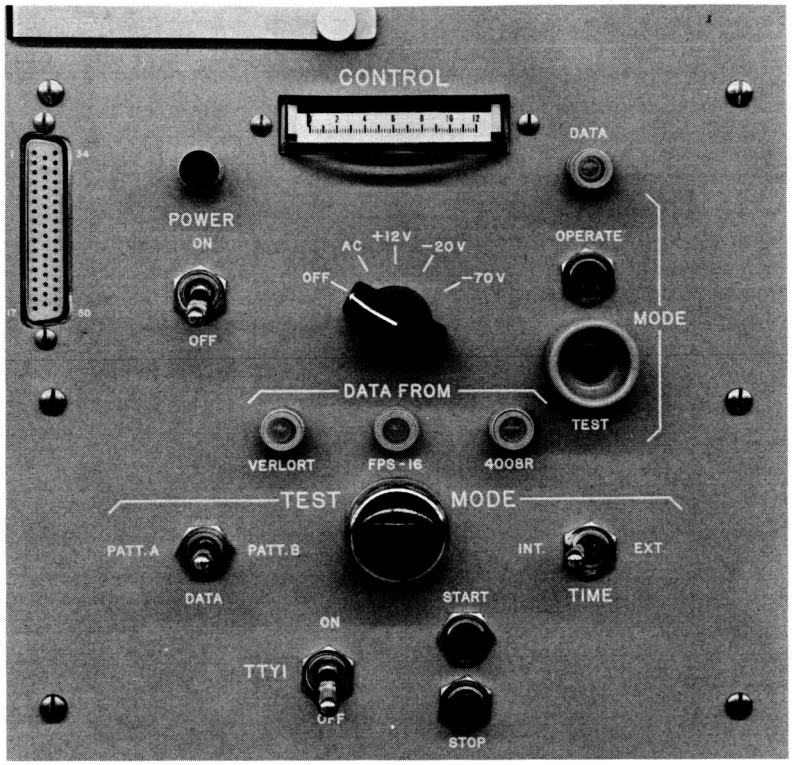
The controls and indicators of the individual items of equipment are listed in Table III-3 together with their purpose, settings and functional indications. The equipment front panels are illustrated in figures 3-2, 3-3, and 3-4 to provide identification of the controls and indicators.

TABLE III-3. DIGITAL-TO-TELETYPE CONVERSION SUBSYSTEM CONTROLS AND INDICATORS

EQUIPMENT	INDICATOR/ CONTROL	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Digital-to-Teletype Converter	POWER switch	Provides 115-volt AC, 60-cycle power to the unit.	ON: Power supplied to unit. OFF: Power off.

TABLE III-3. DIGITAL-TO-TELETYPE CONVERSION SUBSYSTEM CONTROLS AND INDICATORS (Continued)

EQUIPMENT	INDICATOR/ CONTROL	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Digital-to-Teletype Converter (Continued)	POWER indicator	Indicates power on or off.	Red illumination: Power ON. No illumination: Power OFF.
	CONTROL meter	Monitors voltage.	10-scale reading indicates 100% value.
	DATA indicator	Indicates data readout	Intermittent illumination indicates information readout.
	Voltage switch	Monitors functional voltages.	OFF: 0 AC: 10 +12V: 10 -20V: 10 -70V: 10
	OPERATE button	Selects unit for operate mode.	Press to operate. (Several data frame lines print out on 28RO before TEST MODE lamp is extinguished.)
	TEST button	Selects unit for test mode.	Illuminates TEST mode indicator lamp.
	VERLORT indicator	Converter is connected to Verlort radar.	Illuminated indicator: Verlort radar is supplying data.



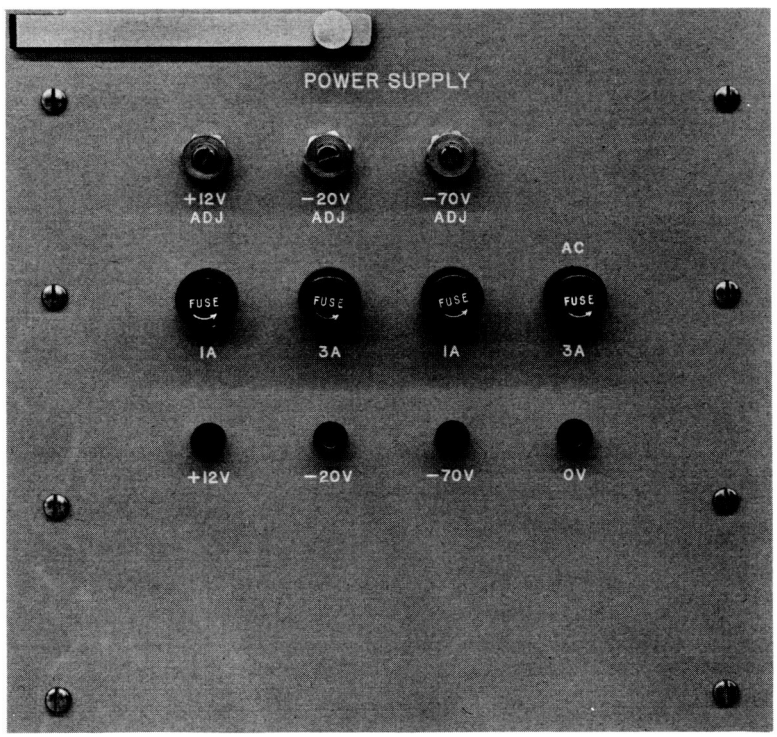


 Figure 3-2. Digital-to-Teletype Converter - Controls and Indicators

TABLE III-3. DIGITAL-TO-TELETYPE CONVERSION SUBSYSTEM CONTROLS AND INDICATORS (Continued)

EQUIPMENT	INDICATOR/ CONTROL	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Digital-to-Teletype Converter (Continued)	FPS-16 indicator	Converter is connected to FPS-16 radar.	Illuminated indicator: FPS-16 radar is supplying data.
	4008R indicator	Converter is connected to data receiver.	Illuminated indicator: Data receiver is supplying data.
	TEST MODE indicator	Indicates unit is in test mode.	Red illumination: Unit is in test mode. No illumination: Unit is in operate mode.
	TEST MODE function	Transfers test pattern A to B, and provides emergency data transmission function.	DATA: Radar data is transmitted during emergency operation. PATT. A: Determined by test input. PATT. B: Determined by test input.
	TIME switch	Switches between local and range time.	INT. : Internal generated timing signal. EXT. : External generated timing signal.

TABLE III-3. DIGITAL-TO-TELETYPE CONVERSION SUBSYSTEM CONTROLS AND INDICATORS (Continued)

EQUIPMENT	INDICATOR/ CONTROL	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Digital-to-Teletype Converter (Continued)	TTY1 switch	Teletype "Blind" control.	ON: "Blind" applied to teletype line in test mode. OFF: Normal operation.
	START button	Initiates start control in test mode.	Press to start test.
	STOP button	Initiates stop control in test mode.	Press to stop test.
	+12V ADJ control	Adjusts +12 volt supply for FPS-16 operation.	Indicated by meter reading.
	-20V ADJ control	Adjusts -20 volt supply for Verlort operation.	Indicated by meter reading.
	-70V ADJ	ADJ. -70 volt supply.	Indicated by meter reading.
	+12V jack	Monitor point.	Indicated by external meter reading.

TABLE III-3. DIGITAL-TO-TELETYPE CONVERSION SUBSYSTEM CONTROLS AND INDICATORS (Continued)

EQUIPMENT	INDICATOR/ CONTROL	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Digital-to-Teletype Converter (Continued)	-20V jack	Monitor point.	Indicated by external meter reading.
	-70V jack	Monitor point.	Indicated by external meter reading.
	OV jack	Monitor point.	Ground.
	CODE SELECTOR rotary switch	Selects digit to be printed in Character 4 of the teletype data frame.	0, 1, 4, 5, 6, 8, and 9.
	CODE SELECTOR toggle switch	Selects either automatic or manual insertion of digits in Character 4 of the teletype data frame.	Auto: Digital-to-Teletype Converter functions automatically and the following digits are printed in Character 4 of the teletype data frame; 2, 3, or 7. Manual: The digits selected by the CODE SELECTOR rotary switch are printed in Character 4 of the teletype data frame.

TABLE III-3. DIGITAL-TO-TELETYPE CONVERSION SUBSYSTEM CONTROLS AND INDICATORS (Continued)

EQUIPMENT	INDICATOR/ CONTROL	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Radar Data Control Unit (Dual)	ON/OFF switch	Controls external power to unit.	ON: Power supplied to unit. OFF: Power disconnected
	VERLORT LINE indicator FPS-16 LINE indicator	Indicates status and condition on teletype lines between converter and Radar Data Control Unit.	No illumination: Line out of service or failure of transmission equipment. Constant illumination: Line and equipment in operating condition. No transmission. Intermittent illumination: Transmission on line.
	VERLORT DATA ACCEPT indicator FPS-16 DATA ACCEPT indicator	Indicates quality of data from radar.	No illumination: Invalid data. Green illumination: Valid tracking data.
	TRANSMIT control/ indicator	1. Actuates circuits to start transmission from D-TT converters.	(Electrically interlocked with STOP control/ indicator.) No illumination: 1. Neither TRANSMIT nor STOP control/indicators operated.

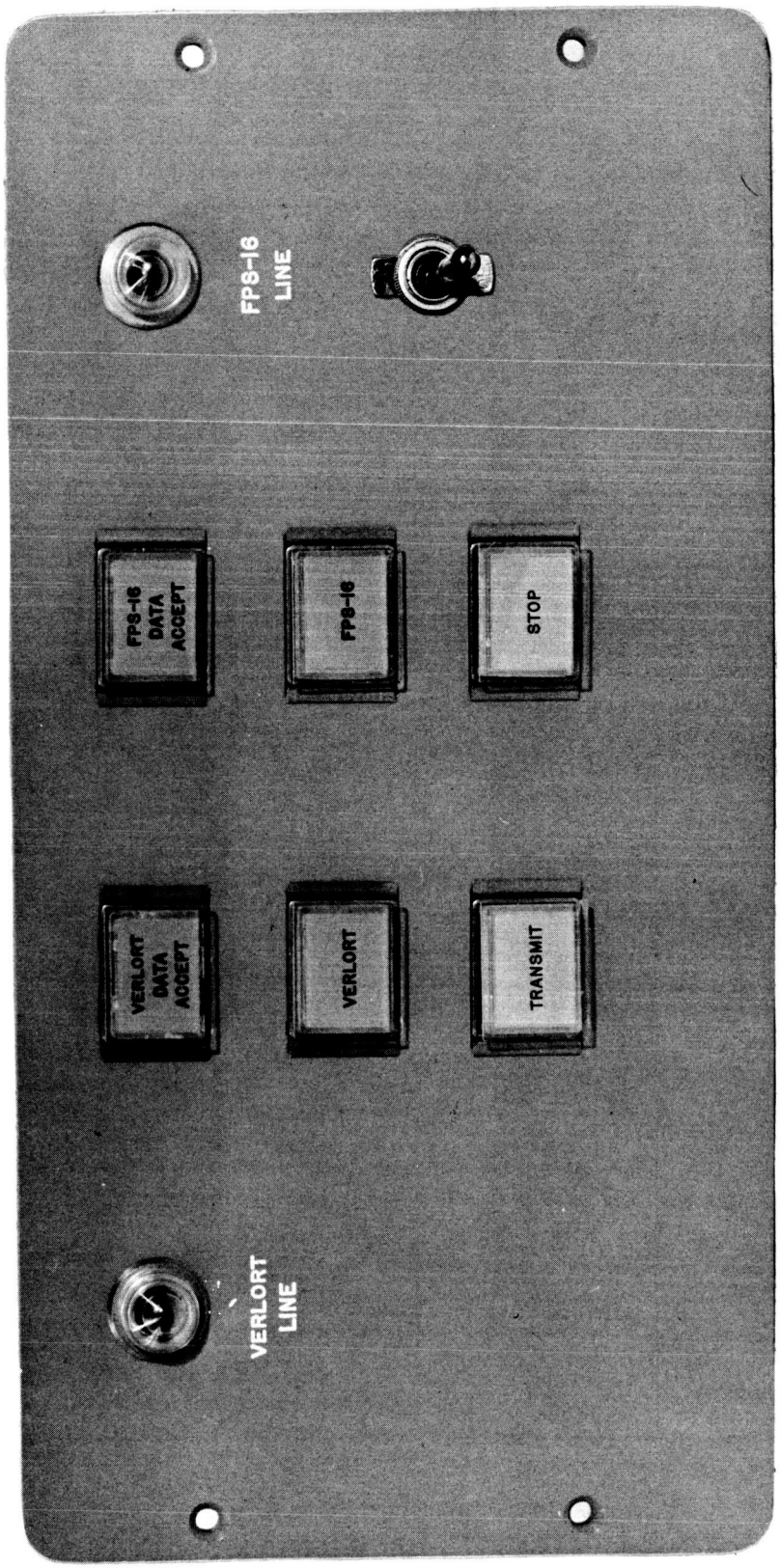


Figure 3-3. Radar Data Control Unit (Dual) - Controls and Indicators

TABLE III-3. DIGITAL-TO-TELETYPE CONVERSION SUBSYSTEM CONTROLS AND INDICATORS (Continued)

EQUIPMENT	INDICATOR/ CONTROL	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Radar Data Control Unit (Dual) (Continued)		2. Connects teletype sending line to D-TT converter selected for transmission.	2. STOP control/ indicator operated. Yellow illumination: TRANSMIT control/ indicator operated. Transmission not started.
		3. Indicates status of transmit command function.	Green illumination: TRANSMIT control/indicator operated. Transmission commanded.
	STOP control/ indicator	1. Actuates circuits to stop transmission from D-TT converters and disconnect teletype transmission.	(Electrically interlocked with TRANSMIT control/ indicator.) No illumination: 1. Neither TRANSMIT nor STOP control/indicators operated. 2. TRANSMIT control/ indicator operated.

TABLE III-3. DIGITAL-TO-TELETYPE CONVERSION SUBSYSTEM CONTROLS AND INDICATORS (Continued)

EQUIPMENT	INDICATOR/ CONTROL	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Radar Data Control Unit (Dual) (Continued)		2. Displays status of stop command function.	Yellow illumination: STOP control/indicator operated. Transmission concluding. Red illumination: STOP control/indicator operated. No transmission.
	VERLORT select control/ indicator FPS-16 select control/ indicator	1. Actuates circuits to select radar for transmission to sending line. 2. Indicates status of selection function.	(Both select control/ indicators are electrically interlocked.) No illumination: Neither select control/indicator operated. Yellow illumination: Select control/indicator operated; other radar completing transmission. White illumination: Radar selected for transmission.
Radar Data Control Unit (Single)	RADAR LINE indicator	Indicates status and condition on teletype lines between Converter and Radar Data Control Unit.	No illumination: Line out of service or failure of transmission equipment. Constant illumination: Line and equipment in operating condition; no transmission. Intermittent illumination: Transmission on line.

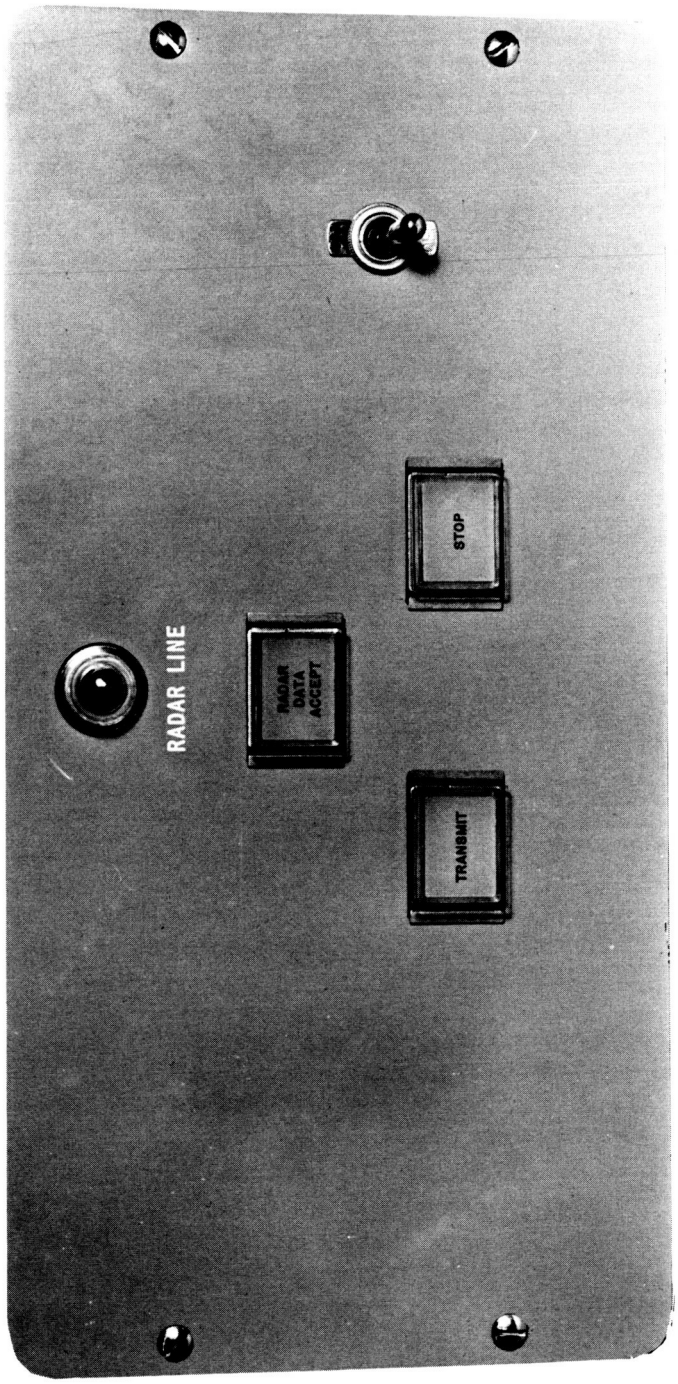


Figure 3-4. Radar Data Control Unit (Single) - Controls and Indicators

TABLE III-3. DIGITAL-TO-TELETYPE CONVERSION SUBSYSTEM CONTROLS AND INDICATORS (Continued)

EQUIPMENT	INDICATOR/ CONTROL	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Radar Data Control Unit (Single) (Continued)	RADAR DATA ACCEPT indicator	Indicates quality of data from radar.	No illumination: Invalid data. Green illumination: Valid tracking data.
	TRANSMIT control/ indicator	1. Connects transmission line to D-TT Converter. 2. Indicates status of transmit command function.	(Electrically interlocked with STOP control/ indicator). No illumination: Neither TRANSMIT nor STOP control/indicators operated, or STOP control/ indicator operated. Yellow illumination: TRANSMIT control indicator operated; no transmission. Green illumination: TRANSMIT control/indicator operated; transmission completed.
	STOP control/ indicator	1. Disconnects transmission line from converter.	(Electrically interlocked with TRANSMIT control/ indicator.) No illumination: Neither TRANSMIT nor STOP control indicators operated, or TRANSMIT control/ indicator operated.

TABLE III-3. DIGITAL-TO-TELETYPE CONVERSION SUBSYSTEM CONTROLS AND INDICATORS (Continued)

EQUIPMENT	INDICATOR/ CONTROL	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Radar Data Control Unit (Single) (Continued)		2. Displays status of stop command function.	Yellow illumination: STOP control/indicator operated; transmission concluded. Red illumination: STOP control/indicator operated; no transmission.
	ON/OFF switch	Controls external power to unit.	ON: Power supplied to unit. OFF: Power disconnected.

3-3. HIGH-SPEED DATA TRANSMISSION SUBSYSTEM

A. GENERAL

High-speed data transmission equipment is furnished at the Bermuda and Cape Canaveral ground instrumentation sites only. Because the equipment complement differs at the two sites, separate discussions, pre-operational test procedures, and adjustment procedures are presented.

B. BERMUDA

The high-speed data transmission equipment furnished at Bermuda consists of two data transmitters and two data receivers for reception and transmission of FPS-16 and Verlort radar data. A tape recorder, controlled from the receivers, is also supplied and serves to monitor all valid tracking information from either (FPS-16 or Verlort) radar. Real time information or pre-recorded information may then be supplied to the IBM Data Communication Channel (DCC).

(1) INITIAL TURN-ON PROCEDURES

(a) PRE-OPERATIONAL TEST PROCEDURE - A pre-operational test procedure is presented in Table III-4 and should be performed before every test or active operation of the subsystem. In the event abnormal indications are observed during performance of the various steps, reference should be made to Section V and Table I-2 of this handbook for applicable maintenance instructions. Power supply adjustment procedures are contained in paragraph 3-3 B (1) (b). The subsystem controls and indicators are illustrated in figures 3-5, 3-6, and 3-7, and explained in Table III-5.

TABLE III-4. HIGH-SPEED DATA TRANSMISSION SUBSYSTEM PRE-OPERATIONAL TEST PROCEDURE - BERMUDA

EQUIPMENT	STEP	PROCEDURE	NORMAL INDICATION
Data Transmitters (FPS-16 and Verlort)	1	Turn FIL circuit breaker switch ON and allow 30-second warmup period.	FIL indicator illuminates.
	2	After 30-second warmup period, turn PLATE circuit breaker switch ON.	PLATE indicator illuminates.
	3	Set VOLTAGE SELECTOR switch at each position (AC, +250V, -250V, +10V, and -10V) and monitor CONTROL meter.	CONTROL meter reads 10 for all positions. (Meter reads 0 for +10V and -10V positions on the FPS-16 transmitter.)
	4	Set VOLTAGE SELECTOR switch at +250V for monitoring during test and active operation.	CONTROL meter reads 10.
Data Receivers (FPS-16 and Verlort)	5	Turn FIL circuit breaker switch ON and allow 30-second warmup period.	FIL indicator illuminates.
	6	After 30-second warmup period, turn PLATE circuit breaker switch ON.	PLATE indicator illuminates.
	7	Set VOLTAGE SELECTOR switch at each position (AC, -450V, -250V, -110V, +110V, and +250V.	CONTROL meter reads 10 for all positions.
	8	Set VOLTAGE SELECTOR switch at +250V for monitoring during test and active operation.	CONTROL meter reads 10.

TABLE III-4. HIGH-SPEED DATA TRANSMISSION SUBSYSTEM PRE-OPERATIONAL TEST PROCEDURE - BERMUDA (Continued)

EQUIPMENT	STEP	PROCEDURE	NORMAL INDICATION
Tape Recorder/ Reproducer	9	Check that record and reproduce heads are clean, and load tape (see Table 1-2 for reference to equipment manual).	
	10	Depress POWER control and allow 10-minute warmup period.	
	11	Depress LOW SPEED control/indicator	LOW SPEED indicator screen illuminates.
Data Transmitter (FPS-16)	12	Position Test/Operate function switch to ALL.	TEST indicator illuminates
	13	Position TIMING switch to RANGE.	
Data Receiver (FPS-16)	14	Position Test/Operate function switch to OP.	
	15	Position RECEIVER switch to 1.	
	16	Set RECORDER CONTROL SWITCH to ON.	Tape reels rotate in forward direction. RECORDER CONTROL indicator illuminates.
Data Transmitter (FPS-16)	17	Depress START button.	
Computer	18	Check azimuth, elevation, and range words.	Azimuth, elevation, and range words are comprised of "ones."

TABLE III-4. HIGH-SPEED DATA TRANSMISSION SUBSYSTEM PRE-OPERATIONAL TEST PROCEDURE - BERMUDA (Continued)

EQUIPMENT	STEP	PROCEDURE	NORMAL INDICATION.
Data Receiver (FPS-16)	19	Set RECORDER CONTROL switch to OFF.	Rotation of tape reels stops and RECORDER CONTROL indicator lamp remains illuminated.
Tape Recorder	20	Depress REWIND control.	Tape reels rotate in reverse direction.
	21	When original tape position is obtained, depress STOP control.	Rotation of tape reels stops.
Data Receiver (FPS-16)	22	Set RECORDER CONTROL switch to ON.	

TABLE III-5. HIGH-SPEED DATA TRANSMISSION SUBSYSTEM CONTROLS AND INDICATORS - BERMUDA

EQUIPMENT	CONTROL/ INDICATOR	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Data Transmitters	START button	Initiates data transmission.	Press to operate.
	CONTROL meter	Provides meter voltage reading.	Reads 10 for all voltages.
	FIL circuit breaker switch PLATE circuit breaker switch	Controls power to filament and plate circuits.	OFF: No power supplied. ON: Power supplied to circuits.

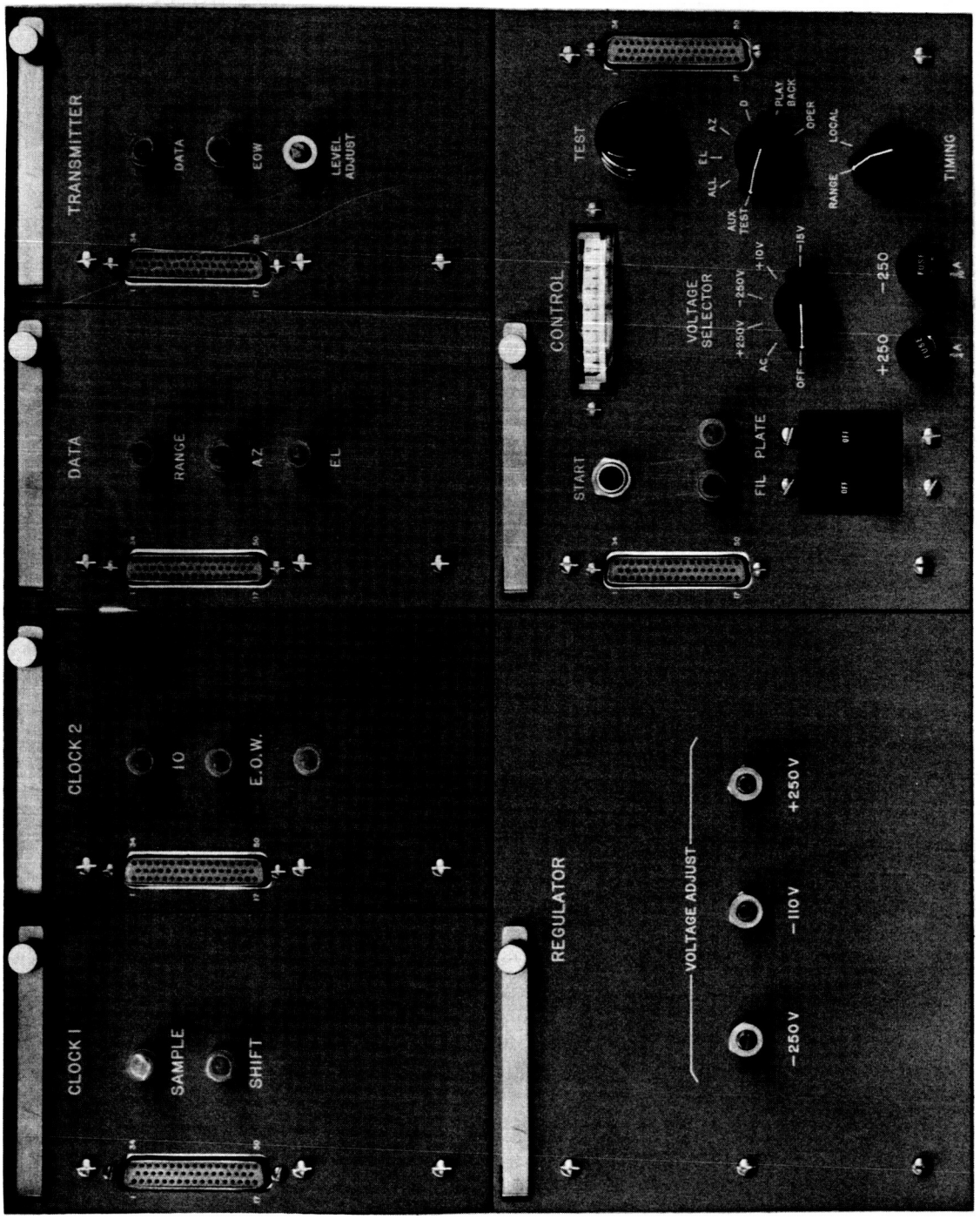


Figure 3-5. Data Transmitter (FPS-16 and Verlort) - Controls and Indicators

TABLE III-5. HIGH-SPEED DATA TRANSMISSION SUBSYSTEM CONTROLS AND INDICATORS - BERMUDA (Continued)

EQUIPMENT	CONTROL/ INDICATOR	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Data Transmitters (Continued)	TIMING selector switch	Selects internal or external timing signals.	RANGE: External timing signals is selected. LOCAL: Internal timing signals is selected.
Data Receivers	RECEIVER switch	Selects mode of operation for one or two receivers	1: One receiver is selected. 1 & 2: Two receivers are selected.
	8-BIT CONTROL meter	Provides meter voltage reading.	Reads 10 for all measured voltages.
	ONE INSERT button	Inserts "ones" in core chassis for testing purposes and initiates operation.	Press to operate.
	Test/Operate function switch	Selects mode of operation.	TEST: Selects data transmitter for test operation. PB/TEST: Selects tape recorder for test operation. PB/OP: Selects tape recorder for normal operation. OP: Selects data transmitter for normal operation.

TABLE III-5. HIGH-SPEED DATA TRANSMISSION SUBSYSTEM CONTROLS AND INDICATORS - BERMUDA (Continued)

EQUIPMENT	CONTROL/ INDICATOR	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Data Receivers (Continued)	VOLTAGE SELECTOR switch	Selects voltages to be measured on CONTROL meter.	OFF: Meter reads 0. Other positions: Meter reads 10.
	FIL indicator	Indicates status of filament power.	No illumination: Filament power off. Illuminated indicator: Filament power on.
	PLATE indicator	Indicates status of plate power.	No illumination: Plate power off. Illuminated indicator: Plate power on.
	FIL circuit breaker switch and PLATE circuit breaker switch	Controls power to filament and plate circuits.	OFF: No power supplied. ON: Power supplied to circuits.
	PB OR TEST indicator	Indicates mode of operation.	No illumination: Test/Operate function switch in OP mode. Illuminated indicator: Test/Operate function switch in TEST, PB TEST, or PB/OP mode.
	RECORDER CONTROL switch	Remotely controls operation of the tape recorder.	OFF: Recorder off. ON: Recorder runs continuously. AUTO: Recorder runs when on-target bit is present.

TABLE III-5. HIGH-SPEED DATA TRANSMISSION SUBSYSTEM CONTROLS AND INDICATORS - BERMUDA (Continued)

EQUIPMENT	CONTROL/ INDICATOR	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Data Receivers (Continued)	RECORDER CONTROL INDICATOR lamp	Indicates mode of operation of recorder selected at the data receiver.	Illuminates when the RECORDER CONTROL switch is in the ON or OFF position.
Tape Recorder/ Reproducer	RECORD control/ indicator	Disconnected.	
	DRIVE control	Disconnected.	Press to operate.
	FAST FWD control	Starts tape in motion at high speed in the forward direction.	Press to operate.
	REWIND control	Starts tape in motion at high speed in the rewind direction.	Press to operate.
	HIGH SPEED control/ indicator	Selects high drive motor speed and de-energizes speed change relays in record amplifiers.	No illumination: Control inoperative. Illuminated indicator: Control operated.

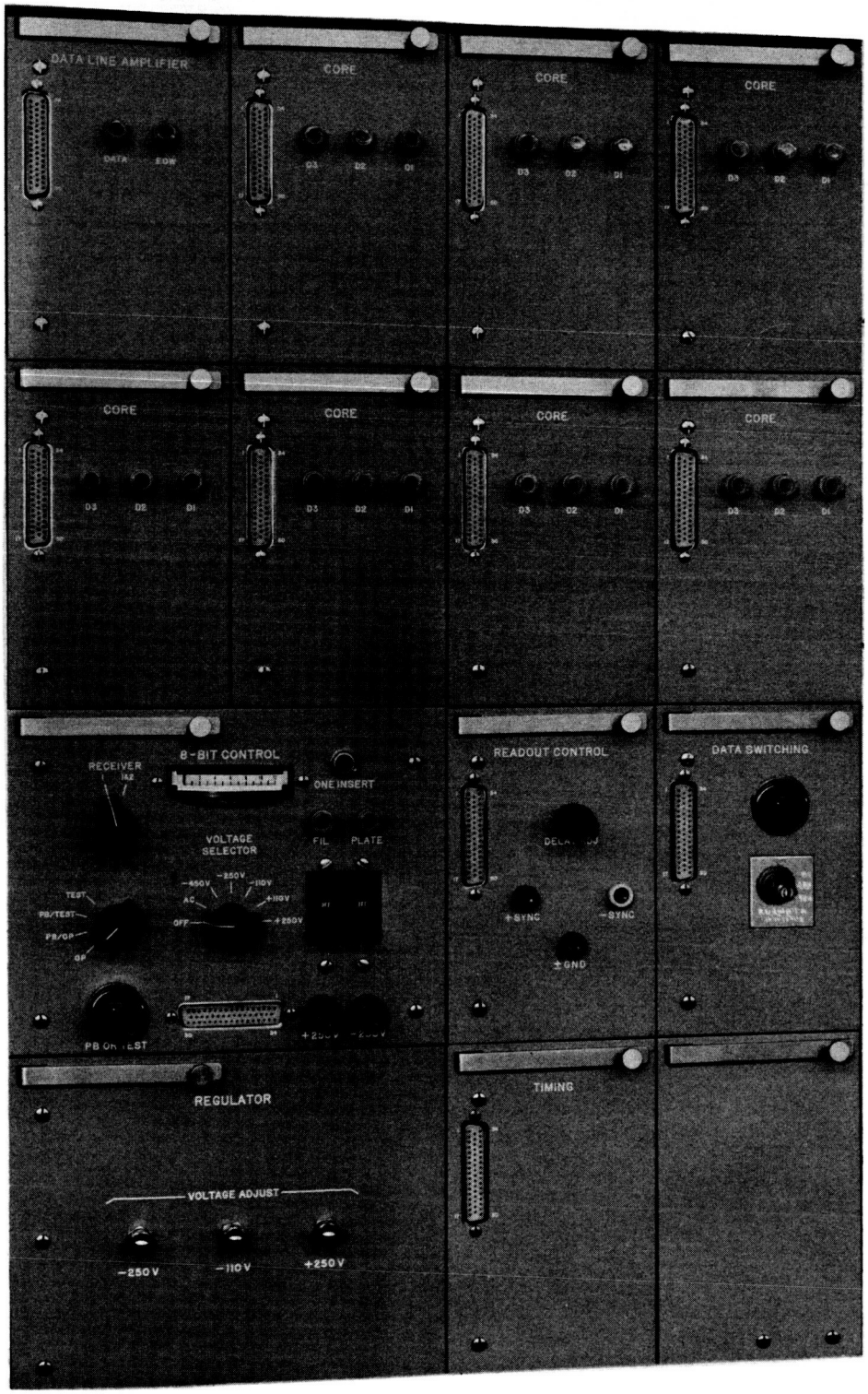


Figure 3-6. Data Receiver (8-Bit) - Controls and Indicators

TABLE III-5. HIGH-SPEED DATA TRANSMISSION SUBSYSTEM CONTROLS AND INDICATORS - BERMUDA (Continued)

EQUIPMENT	CONTROL/ INDICATOR	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Tape Recorder/ Reproducer (Continued)	LOW SPEED control/ indicator	Selects low drive motor speed and energizes speed change relays in record amplifiers.	No illumination: Control inoperative. Illuminated indicator: Control operated.
	POWER control	Applies power to tape transport circuits.	
	STOP control	Stops tape motion.	

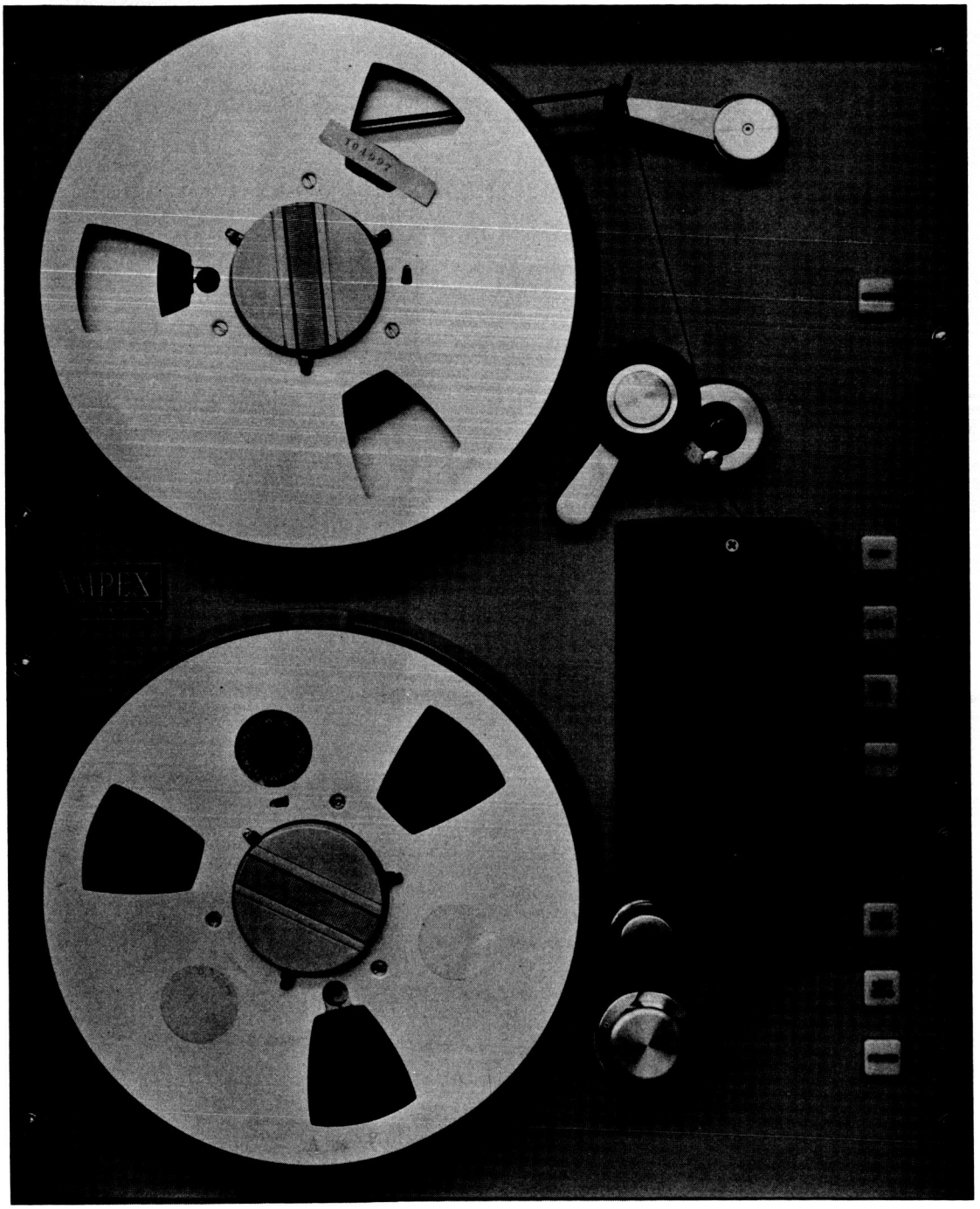


Figure 3-7. Tape Recorder/Reproducer - Controls and Indicators

(b) ADJUSTMENTS - The following adjustment procedures should be performed to insure that proper voltage requirements are furnished to the equipment components.

1. DATA TRANSMITTERS (Verlort and FPS-16)

a. Turn FIL circuit breaker switch ON and allow 30-second warmup period.

b. Turn PLATE circuit breaker switch ON.

c. Position VOLTAGE SELECTOR switch to +250V.

d. Loosen locknut on +250 VOLTAGE ADJUST control and adjust so that 10 ±0.5 is read on CONTROL meter.

e. Secure locknut.

f. Position VOLTAGE SELECTOR switch to -250V.

g. Loosen locknut on -250V VOLTAGE ADJUST control and adjust so that 10 ±0.5 is read on CONTROL meter.

h. Secure locknut.

i. Position VOLTAGE SELECTOR switch to -10V (on 4008-1B only).

j. Loosen locknut on -110V VOLTAGE ADJUST control and adjust so that 10 ±0.5 is read on CONTROL meter.

k. Secure locknut.

2. DATA RECEIVERS (Verlort and FPS-16)

a. Turn FIL circuit breaker switch ON and allow 30-second warmup period.

b. Turn PLATE circuit breaker switch ON.

c. Position VOLTAGE SELECTOR switch to -250V.

d. Loosen locknut on -250V VOLTAGE ADJUST control and adjust so that 10 ±0.5 is read on CONTROL meter.

e. Secure locknut.

f. Position VOLTAGE SELECTOR switch to -110V.

g. Loosen locknut on -110V VOLTAGE ADJUST control and adjust so that 10 ±0.5 is read on CONTROL meter.

h. Secure locknut.

i. Position VOLTAGE SELECTOR switch to +250V.

j. Loosen locknut on +250V VOLTAGE ADJUST control and adjust so that 10 ±0.5 is read on CONTROL meter.

k. Secure locknut.

(c) OPERATION - The high-speed data transmission subsystem furnished at Bermuda may be arranged for four different modes of operation. The data receivers provide the means of selecting the various modes after the associated data transmitters have been set up and the tape recorder is turned on.

1. NORMAL OPERATION - Normal operation consists of positioning the Test/Operate switches on the data receivers and data transmitters to OP and OPER, respectively. Real time information will then be transmitted directly to the computer.

2. PLAYBACK OPERATION - With the Test/Operate switches on the data receivers set at PB/OP, recorded data will be transmitted directly to the computer.

3. TEST OPERATION - Test operation consists of selecting the OPER mode at the data transmitters and the TEST mode at the data

receivers. Real time information will then be transmitted to the data transmitters, but not fed to the computer.

4. PLAYBACK TEST OPERATION - Playback test operation consists of selecting the PB/TEST mode at the data receivers. Recorded data will then be transmitted to the data receivers, but not fed to the computer.

5. SIMULATED VALID DATA BIT PROVISION - In order that test messages may be recorded from the data transmitters, conditions necessary to activate recorder data may be simulated at the data receivers. If it is desired to record test information from the data transmitters, as is required in the pre-operational test procedure, the RECORDER CONTROL switch, located on the data receiver front panel (Data Switching) should be placed in the ON position.

C. CAPE CANAVERAL

A high speed data receiver (36-bit) is furnished at the Cape Canaveral installation. The purpose of this special data receiver is to arrange radar tracking data from two FPS-16 radars and one XN-2 radar into a format acceptable to the digital-to-teletype conversion subsystem.

(1) INITIAL TURN-ON PROCEDURES

(a) PRE-OPERATIONAL TEST PROCEDURE - A pre-operational test procedure is detailed in Table III-6 and should be performed before every test or active operation. Subsystem maintenance instructions are contained in the maintenance section of this handbook in the event abnormal indications are observed during performance of the various steps of the test. Detailed equipment maintenance instructions may be obtained in the equipment handbook which is referenced in Table I-2. The equipment controls and indicators are illustrated in figure 3-8 and are identified in Table III-7.

(b) ADJUSTMENTS - The data receiver adjustment procedure detailed in paragraph 3-3B(2) applies to the 36-bit receiver and should be performed to insure that proper voltage requirements are furnished to the equipment components.

(2) OPERATION - Operation of the data receiver furnished at Cape Canaveral consists of selecting any of the three radar inputs at the DATA SELECT switch (positions 1 or 2 or 3) and positioning SELECT and WORD DISPLAY switches to OPER.

TABLE III-6. HIGH-SPEED DATA TRANSMISSION SUBSYSTEM PRE-OPERATIONAL TEST PROCEDURE - CAPE CANAVERAL

EQUIPMENT	STEP	PROCEDURE	NORMAL INDICATION
Digital-to-Teletype Converter	1	Perform steps 1 through 8 of Table III-1.	4008R test patterns A and B (Table III-2) are read on 28 RO.

TABLE III-6. HIGH-SPEED DATA TRANSMISSION SUBSYSTEM PRE-OPERATIONAL TEST PROCEDURE - CAPE CANAVERAL (Continued)

EQUIPMENT	STEP	PROCEDURE	NORMAL INDICATION
Digital-to-Teletype Converter (Continued)	2	Turn FIL circuit breaker switch on and allow 30-second warmup.	FIL indicator illuminates.
Data Receiver	3	After 30-second warm-up period, turn PLATE circuit breaker switch on.	PLATE indicator illuminates.
	4	Set VOLTAGE SELECTOR switch at each position (AC, -250V +250V, +110V, -110V, -450V, and +10V) and monitor CONTROL meter.	CONTROL meter reads 10 for all positions.
	5	Set VOLTAGE SELECTOR switch at +250V for monitoring during test and active operation.	CONTROL meter reads 10.
	6	Position DATA SELECT switch to 1.	
	7	Position SELECT switch to OPER.	
	8	Position WORD DISPLAY switch to OPER.	
28 RO Page Printer	9	Turn on 28 RO page printer and request Cape Canaveral FPS-16 radar operator to transmit test message.	

TABLE III-6. HIGH-SPEED DATA TRANSMISSION SUBSYSTEM PRE-OPERATIONAL TEST PROCEDURE - CAPE CANAVERAL (Continued)

EQUIPMENT	STEP	PROCEDURE	NORMAL INDICATION
Converter and Page Printer	10	Depress START button on digital-to-teletype converter	Test message is read on page printer.
	11	Confirm proper test message pattern with radar operator.	
	12	Depress STOP control on digital-to-teletype converter.	Page printer prints last line.
Data Receiver	13	Position DATA SELECT switch to 2 and request XN-2 Grand Bahama radar operator to transmit test message.	
	14	Perform steps 7 through 12.	
	15	Position DATA SELECT switch to 3 and request FPS-16 San Salvador radar operator to transmit test message.	
	16	Perform steps 7 through 12.	

TABLE III-7. HIGH-SPEED DATA TRANSMISSION SUBSYSTEM CONTROLS AND INDICATORS - CAPE CANAVERAL

EQUIPMENT	CONTROL/ INDICATOR	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Data Receiver	1 INSERT button	Inserts "ones" in core chassis for testing purposes.	Press to operate.
	CONTROL meter	Provides meter voltage reading.	Reads 10 for all measured voltages.
	TEST indicator	Indicates mode of operation.	Illuminated indicator: Receiver is in test mode of operation. No illumination: Receiver is in operate mode.
	DATA SELECT switch	Selects radar data inputs.	1: Cape Canaveral FPS-16 radar is selected. 2: Grand Bahama XN-2 radar is selected. 3: San Salvador FPS-16 radar is selected. 4: Spare.
	VOLTAGE SELECTOR switch	Selects voltages to be measured on CONTROL meter.	OFF: Meter reads 0. Other positions: Meter reads 10.
	WORD DISPLAY switch	Selects data for display on core chassis data indicators.	OPER: Normal operation. 1: Range word selected. 2: Azimuth word selected. 3: Elevation word selected.
	FIL indicator	Indicates status of filament power.	No illumination: Filament power off. Illuminated indicator: Filament power on.

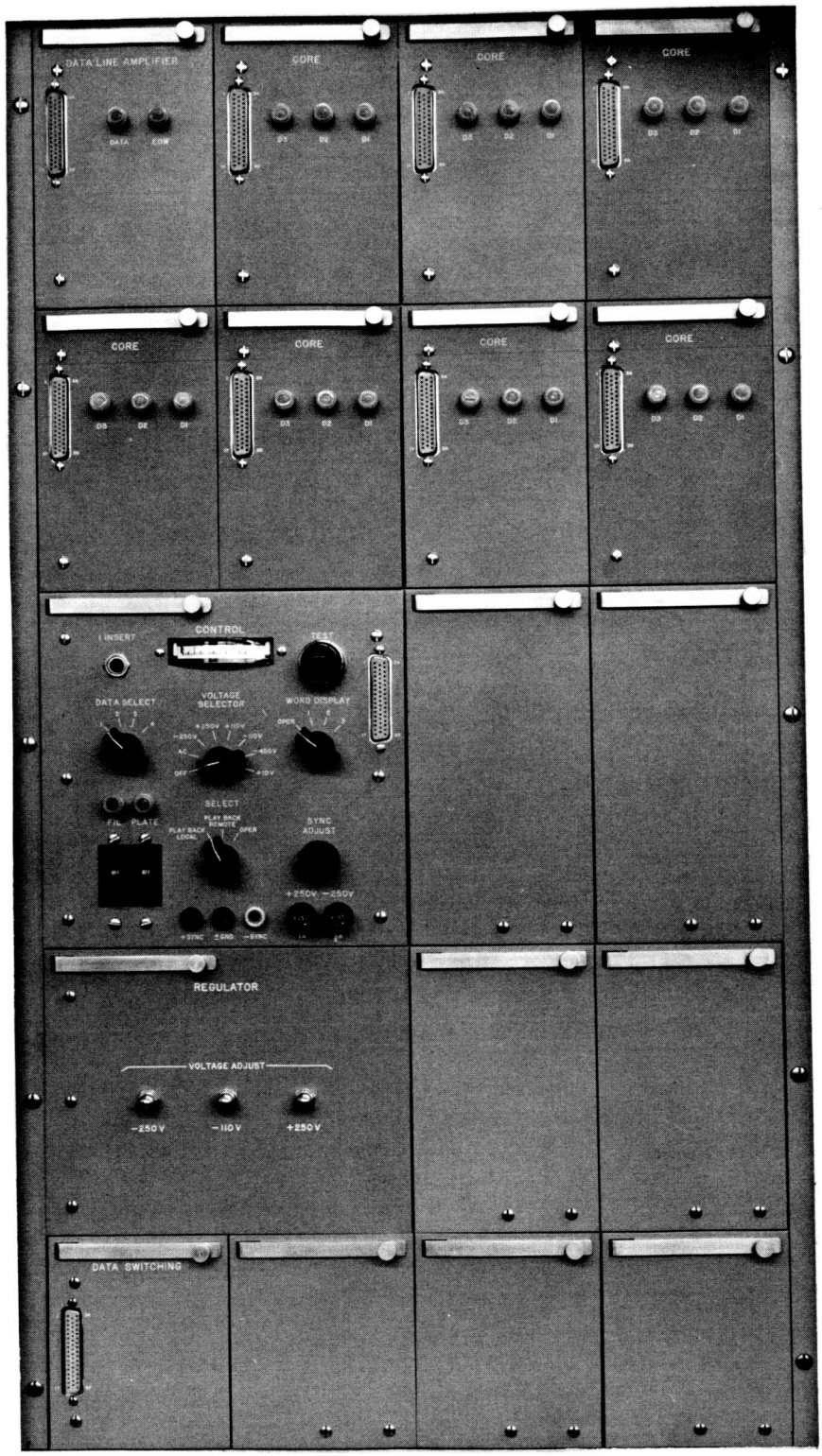


Figure 3-8. Data Receiver (36-Bit) - Controls and Indicators

TABLE III-7. HIGH-SPEED DATA TRANSMISSION SUBSYSTEM CONTROLS AND INDICATORS - CAPE CANAVERAL (Continued)

EQUIPMENT	CONTROL/ INDICATOR	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Data Receiver (Continued)	PLATE Indicator	Indicates status of plate power.	No illumination: Plate power off. Illuminated indicator: Plate power on.
	FIL circuit breaker switch and PLATE circuit breaker switch	Controls external power to filament and plate circuits.	OFF: No power supplied. ON: Power supplied to circuits.
	SELECT control	Selects mode of operation.	PLAY BACK LOCAL: Not connected. PLAY BACK REMOTE: Not connected. OPER: Normal operation.

3-4. PREPARATION OF TELEMETRY AND TIME INFORMATION

A. GENERAL

This subsystem includes two items of equipment with similar functions in the digital data processing system, but unrelated with respect to site location, operation, and physical characteristics. Therefore, separate instructions are presented for the two equipment items.

B. INITIAL TURN-ON PROCEDURES

(1) TELEMETRY/EVENT BUFFER - BERMUDA - The initial turn-on procedure for the telemetry/event buffer furnished to the Bermuda ground instrumentation site consists of a pre-operational test. The step-by-step procedure is detailed in Table III-8 and should be performed before each test or active operation of the equipment. Should an indication other than normal occur during the procedure, refer to applicable equipment manual listed in Table I-2. Illustrations and tabular information are presented for the controls and indicators in figures 3-9 and 3-10, and Table III-9, respectively.

(2) TELEMETRY/EVENT TRANSMITTING BUFFER - CAPE CANAVERAL - A pre-operational test procedure (Table III-10) serves as the initial turn-on procedure for the telemetry/event transmitting buffer furnished at Cape Canaveral. The controls and indicators are listed in Table III-11 and are illustrated in figures 3-10 and 3-11. The procedure applies to, and should be performed for, both buffer units and both power supply units. If an abnormal indication is noted during the performance of the test procedure, refer to applicable equipment handbook listed in Table I-2.

Three operational modes are provided in the operation of the telemetry/event transmitting buffer. Normal operation consists of turning both power supply units on and positioning the OUTPUT LINE SELECTOR switch to BOTH. Because the inputs and outputs of both buffer units are identical, one buffer unit may transmit data to both the IP-709 and G. E. -Burroughs buildings in the event of an emergency. This function is accomplished by selecting either BUFFER I or BUFFER II with the OUTPUT LINE SELECTOR switch. A third type of operational mode (simulate) enables the buffer to be controlled by an external tape unit. With the OUTPUT LINE SELECTOR switch positioned to SIMULATE, telemetry start pulses from the tape unit cause the buffer to operate normally for one complete cycle then return to control of the tape unit.

C. POWER SUPPLY ADJUSTMENT PROCEDURE

The following procedure details the method of adjusting the Telemetry/Event Buffer and the Telemetry/Event Transmitting Buffer power supply units. The +15 and -15 volt adjustment controls are located on their respective chassis tops. The -100 volt adjustment control consists of a variable resistor mounted on the chassis top which may be adjusted to vary the output of the unregulated power supply.

(1) Loosen the four panel mounting screws and partially withdraw the power supply chassis from the cabinet.

(2) Position METER SELECTOR switch to +15.

(3) Loosen locknut on +15 VOLT ADJ. control.

(4) Observing the power supply D. C. VOLTS meter, adjust the +15 VOLT. ADJ. control to +15 volts ±1. 0 volt.

(5) Tighten locknut on +15 VOLT. ADJ. control.

(6) Perform steps (2) through (5) for -15 VOLT. ADJ. control.

(7) Position METER SELECTOR switch to -100.

(8) Loosen -100 volt power supply resistor mounting clamp and slide clamp so that 10 volts ±0. 5 volts is read on the D. C. VOLTS meter.

(9) Tighten resistor mounting clamp.

TABLE III-8. PREPARATION OF TELEMETRY AND TIME INFORMATION SUBSYSTEM PRE-OPERATIONAL TEST PROCEDURE - BERMUDA

EQUIPMENT	STEP	PROCEDURE	NORMAL INDICATION
Telemetry/ Event Buffer	1	Turn POWER SAFETY switch on.	Power indicator illuminates red, D. C. VOLTS meter reads voltage, and blower operates.
	2	Position DC VOLTAGE MONITOR switch to 15.	D. C. VOLTS meter reads 15 volts ±1. 0 volt.
	3	Position DC VOLTAGE MONITOR switch to -15.	D. C. VOLTS meter reads 15 volts ±1. 0 volt.
	4	Position DC VOLTAGE MONITOR switch to -100.	D. C. VOLTS meter reads 10 volts ±0. 5 volt.
	5	Expose buffer unit test shelf by removing the panel mounting screws and withdrawing the unit from the cabinet.	
	6	Position Test/Operate switch to TEST.	TEST indicator illuminates red, DATA indicators 1 through 8 illuminate, and one SEQUENCER indicator (A through H) illuminates.
	7	Operate PULSE SIMULATOR switch first to the forward position, then to the reverse position, until SEQUENCER indicator A illuminates.	FIRST WORD UP indicator illuminates and DATA indicators remain illuminated.

TABLE III-8. PREPARATION OF TELEMETRY AND TIME INFORMATION SUBSYSTEM PRE-OPERATIONAL TEST PROCEDURE - BERMUDA (Continued)

EQUIPMENT	STEP	PROCEDURE	NORMAL INDICATION
Telemetry/ Event Buffer (Continued)	8	Operate CET switch.	TIME SIMULATOR indicator illuminates intermittently and DATA indicators remain illuminated.
	9	Operate CET switch in sequences B and C.	SEQUENCER indicator B or C illuminates, TIME SIMULATOR indicator illuminates intermittently, and DATA indicators illuminate.
	10	Operate TOR switch in sequences D, E, and F.	SEQUENCER indicator D, E, or F illuminate, TIME SIMULATOR indicator illuminates intermittently, and DATA indicators illuminate.
	11a	Operate both CET and TOR switches in sequences G and H.	All data indicators illuminate TIME SIMULATOR indicator does not illuminate.
	11b	Operate TOR switches in sequences A, B, and C.	
	11c	Operate CET switch in sequences D, E, and F.	

TABLE III-8. PREPARATION OF TELEMETRY AND TIME INFORMATION SUBSYSTEM PRE-OPERATIONAL TEST PROCEDURE - BERMUDA (Continued)

EQUIPMENT	STEP	PROCEDURE	NORMAL INDICATION
Telemetry/ Event Buffer (Continued)	12	Position Test/Operate switch to OPR and step sequencer through each sequence.	SEQUENCER indicators A through H illuminate, DATA indicators do not illuminate, and SPECIAL EVENT indicator illuminates intermittently.

TABLE III-9. PREPARATION OF TELEMETRY AND TIME INFORMATION SUBSYSTEM CONTROLS AND INDICATORS - BERMUDA

EQUIPMENT	CONTROL/ INDICATOR	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Buffer Unit	DATA indicators 1 through 8	Provides indication for testing data paths from DC "AND" gates through output "OR" gates.	Indicator illuminated: Data path in sequence being tested is functioning properly. No illumination: Trouble in data path being tested.
	PULSE SIMULATOR switch	Steps the buffer through sequences A through H.	Operate switch to forward position then to reverse position to step the buffer to the next sequence.

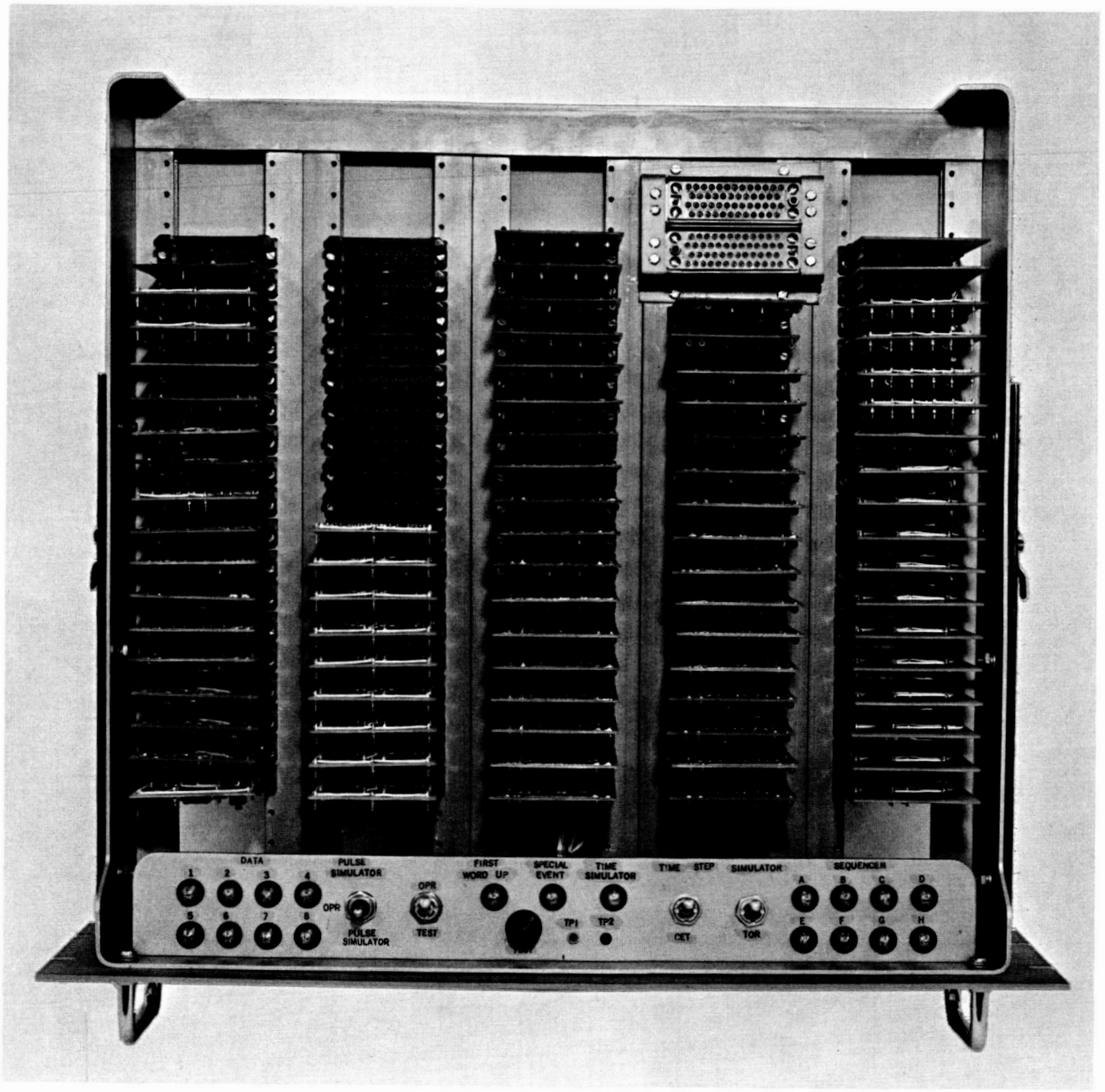


Figure 3-9. Telemetry/Event Buffer, Buffer Unit - Controls and Indicators

TABLE III-9. PREPARATION OF TELEMETRY AND TIME INFORMATION SUBSYSTEM CONTROLS AND INDICATORS - BERMUDA (Continued)

EQUIPMENT	CONTROL/ INDICATOR	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Buffer Unit (Continued)	Test/Operate switch	Switches the buffer to either the test or operate mode.	OPR: Normal mode of operation. TEST: Test mode of operation.
	FIRST WORD UP indicator	Indicates status of first word circuit.	Indicator illuminated: First word circuit is functioning properly. No illumination: Malfunction in first word circuit.
	SPECIAL EVENT indicator	Indicates status of special event circuit.	Indicator illuminated: Special event circuit is functioning properly. No illumination: Malfunction in special event circuit.
	TIME SIMULATOR indicator	Indicates status of ambiguity circuits.	Indicator illuminated: Ambiguity circuit is functioning properly. No illumination: Malfunction is ambiguity circuit.
	TEST indicator	Indicates test mode of operation.	Red illumination: Buffer is in test mode of operation.
	TP1 jack	Provides facility for checking +15 volt input.	Multimeter reads +15 volts ±1.0 volt.

TABLE III-9. PREPARATION OF TELEMETRY AND TIME INFORMATION SUBSYSTEM CONTROL AND INDICATORS - BERMUDA (Continued)

EQUIPMENT	CONTROL/ INDICATOR	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Buffer Unit (Continued)	TP2 jack	Provides facility for checking -15 volt input.	Multimeter reads -15 volts ±1.0 volt.
	CET switch	Connects simulated analog data to test capsule elapsed time ambiguity circuit.	Press to operate.
	TOR switch	Connects simulated analog data to test time of retrofire ambiguity circuit.	Press to operate.
	Sequencer indicators A through H	Indicates which sequence the buffer is in.	Illuminated indicator: The buffer is in the sequence indicated.
Power Supply Unit	POWER SAFETY switch	Turn power supply on or off.	Guard open: Power supply is on and controlled from display console. Guard closed: Power supply may be turned on or off.
	D. C. VOLTS meter	Monitors d-c voltage outputs.	-100 volts is read as 10 volts. -15 volts is read as 15 volts. +15 volts is read as 15 volts.

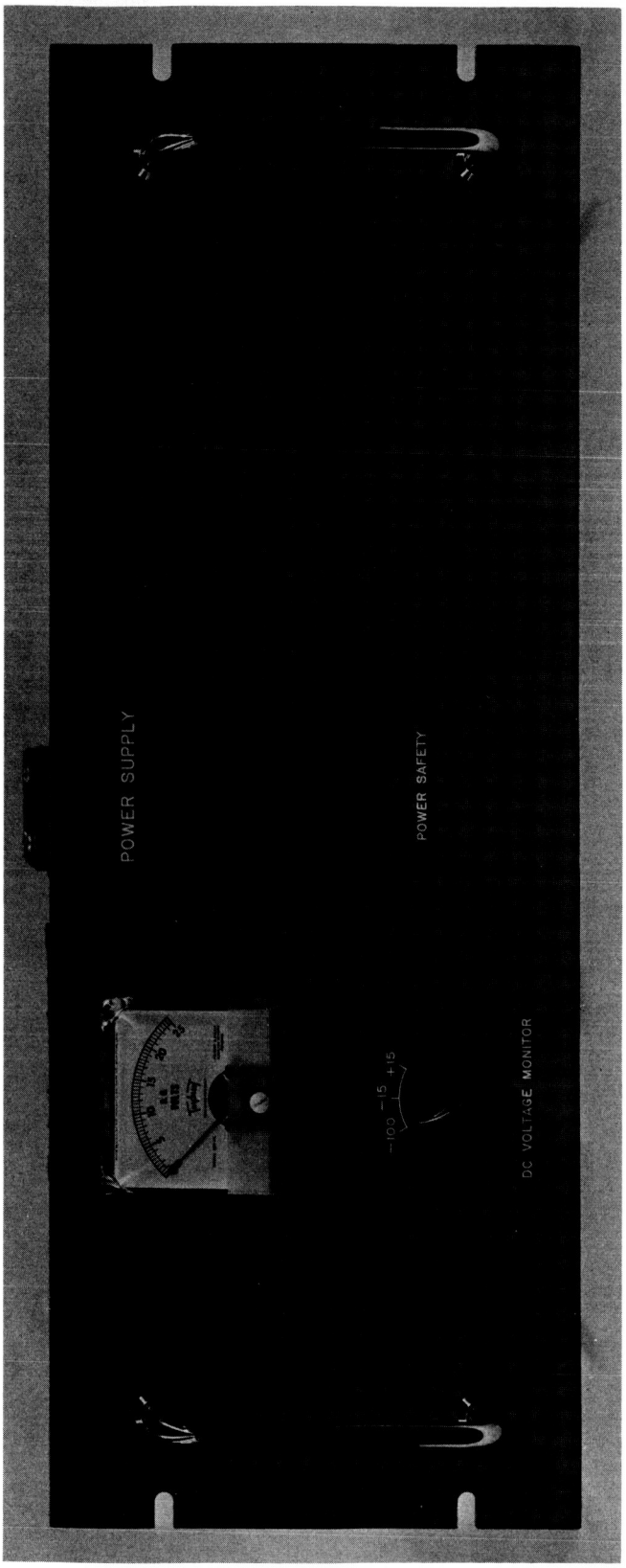


Figure 3-10. Power Supply Unit, Telemetry/Event Buffer and Telemetry/Event Transmitting Buffer - Controls and Indicators

TABLE III-9. PREPARATION OF TELEMETRY AND TIME INFORMATION SUBSYSTEM CONTROL AND INDICATORS - BERMUDA (Continued)

EQUIPMENT	CONTROL/ INDICATOR	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Power Supply Unit (Continued)	DC VOLTAGE MONITOR switch	Selects d-c voltage outputs to be measured.	-100: -100 volt output is selected. -15: -15 volt output is selected. +15: +15 volt output is selected.
	VOLT. ADJ. controls	Adjusts power supply outputs.	Adjust to required limits.
	Power Indicator	Indicates power on or off.	Red illumination: Power on. No illumination: Power off.

TABLE III-10. PREPARATION OF TELEMETRY AND TIME INFORMATION SUBSYSTEM PRE-OPERATIONAL TEST PROCEDURE - CAPE CANAVERAL

EQUIPMENT	STEP	PROCEDURE	NORMAL INDICATION
Telemetry/ Event Transmitting Buffer	1	Turn POWER SAFETY switches on.	Power indicators illuminate red, D. C. VOLTS meters read voltage, and blower operates.
	2	Position DC VOLTAGE MONITOR switches to +15.	D. C. VOLTS meters read 15 volts ±1. 0 volt.

TABLE III-10. PREPARATION OF TELEMETRY AND TIME INFORMATION SUBSYSTEM PRE-OPERATIONAL TEST PROCEDURE - CAPE CANAVERAL (Continued)

EQUIPMENT	STEP	PROCEDURE	NORMAL INDICATION
Telemetry/ Event Transmitting Buffer (Continued)	3	Position DC VOLTAGE MONITOR switches to -15.	D. C. VOLTS meters read 15 volts ±1. 0 volt.
	4	Position DC VOLTAGE MONITOR switches to -100.	D. C. VOLTS meters read 10 volts ±0. 5 volt.
	5	Expose the buffer units test shelves by removing the panel mounting screws and withdrawing the units from the cabinet.	
	6	Position Test/Operate switches to TEST and OUTPUT LINE SELECTOR switch to BOTH.	OUTPUT MONITOR indicators illuminate constantly. OPERATE indicator illuminates green.
	7	Position Test/Operate switches to OPERATE.	OUTPUT MONITOR indicators illuminate intermittently.

TABLE III-11. PREPARATION OF TELEMETRY AND TIME INFORMATION SUBSYSTEM CONTROLS AND INDICATORS - CAPE CANAVERAL

EQUIPMENT	CONTROL/ INDICATOR	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Output Selector Panel	OUTPUT LINE SELECTOR switch	Selects mode of supplying buffer outputs.	BUFFER I: Buffer unit No. I supplies both outputs. BOTH: Buffer unit No. I supplies one output and buffer unit No. II supplies one output. BUFFER II: Buffer unit No. II supplies both outputs.
	Test/ Simulate indicator	Indicates operation status.	No illumination: Normal operation. Red illumination: Either or both buffers are in test mode, or OUTPUT LINE SELECTOR switch is in SIMULATE position.
	OPERATE indicator	Indicates operation status.	No illumination: OUTPUT LINE SELECTOR switch is in SIMULATE position. Green illumination: Both buffer units are in normal mode of operation.
Buffer Units I and II	ERROR indicator	Provides indication for circuit testing.	No illumination: Circuit is functioning properly. Flashing illumination: Error in circuit.

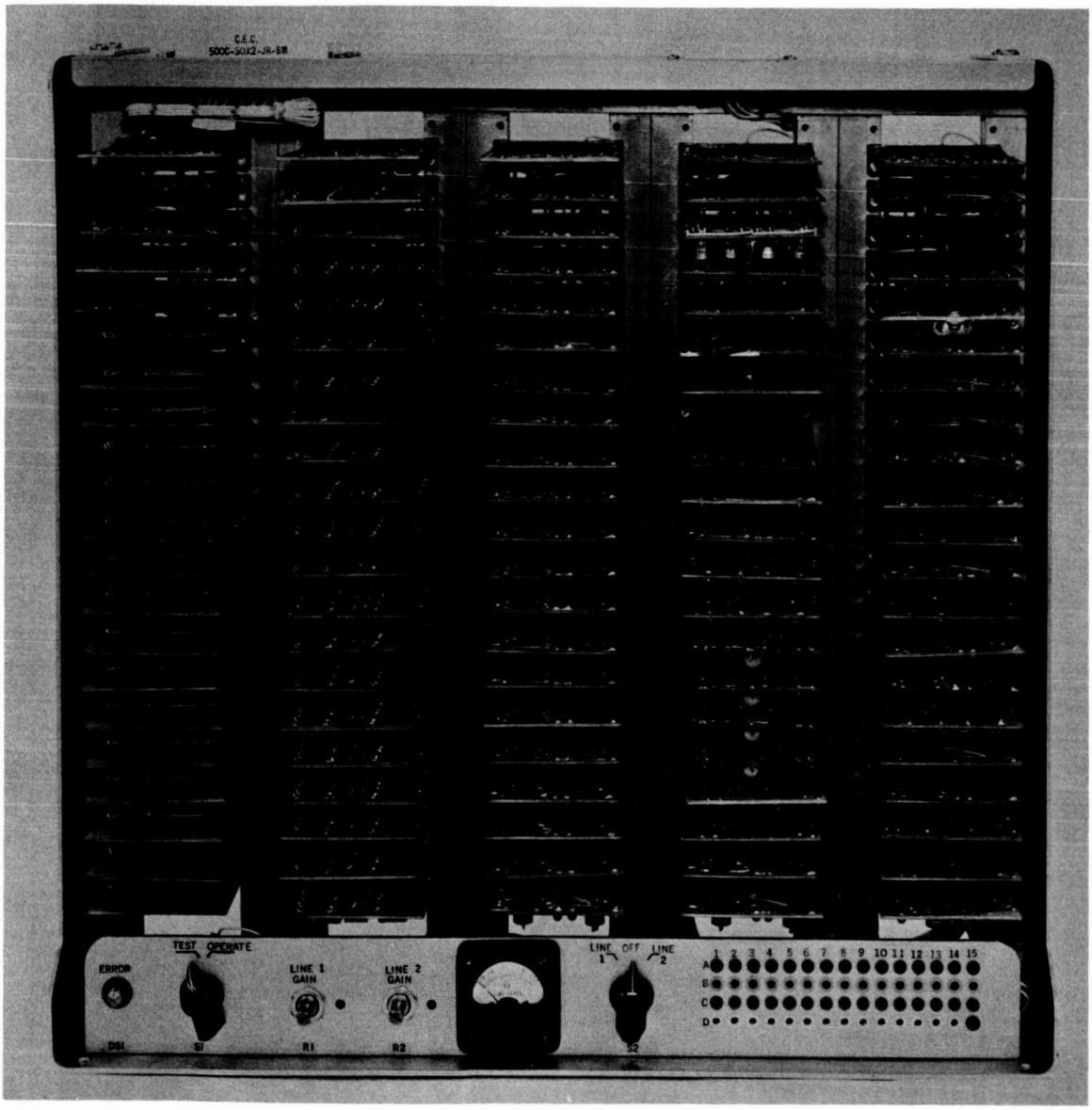


Figure 3-11. Telemetry/Event Transmitting Buffer, Buffer Unit - Controls and Indicators

TABLE III-11. PREPARATION OF TELEMETRY AND TIME INFORMATION SUBSYSTEM CONTROLS AND INDICATORS - CAPE CANAVERAL (Continued)

EQUIPMENT	CONTROL/ INDICATOR	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Buffer Units I and II (Continued)	Test/ Operate switch	Permits quick self test of buffer unit.	OPERATE: Buffer is in normal mode of operation. TEST: Buffer is in self test mode of operation.
	LINE 1 GAIN adjustment control	Adjusts output level of line 1.	Adjust to increase or decrease gain of output.
	LINE 2 GAIN adjustment control	Adjusts output level of line 2.	Adjust to increase or decrease gain of output.
	db LINE LEVEL meter	Indicates amount of gain.	Reads amount of gain of LINE 1 and LINE 2 outputs.
	Meter Selector switch	Selects LINE 1 and LINE 2 for meter monitoring.	LINE 1: The output of LINE 1 is monitored. OFF: db LINE LEVEL meter is inactive. LINE 2: The output of LINE 2 is monitored.

TABLE III-11. PREPARATION OF TELEMETRY AND TIME INFORMATION SUBSYSTEM CONTROLS AND INDICATORS - CAPE CANAVERAL (Continued)

EQUIPMENT	CONTROL/ INDICATOR	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Buffer Units I and II (Continued)	Output Monitor indicator	Monitors output signal.	No illumination: Buffer is inoperative. Intermittent Red Illumination: Buffer is operating normally. Steady Red Illumination: Buffer is in TEST position and no errors are present.
	Jacks A1 through D15	Provide individual testing of modules.	Insert test probe.
Power Supply Units	POWER SAFETY switch	Turns power supply on or off.	Guard Closed: Power supply is off. Guard Open: Power supply may be turned on or off.
	DC VOLTS meter	Monitors d-c voltage outputs.	-100 volts is read as 10 volts.
	DC VOLTAGE MONITOR switch	Selects d-c voltage outputs to be measured.	-100: Selects -100 volt output. -15: Selects -15 volt output. +15: Selects +15 volt output.

TABLE III-11. PREPARATION OF TELEMETRY AND TIME INFORMATION SUBSYSTEM CONTROLS AND INDICATORS - CAP CANAVERAL (Continued)

EQUIPMENT	CONTROL/ INDICATOR	PURPOSE	SETTINGS AND FUNCTIONAL INDICATIONS
Power Supply Units (Continued)	VOLT. ADJ. controls	Adjust power supply outputs.	Adjust to required limits.
	Power indicator	Indicates power on or off.	Red Illumination: Power on. No Illumination: Power off.

SECTION IV
THEORY OF SYSTEM OPERATION

4-1. GENERAL

The Project Mercury digital data processing system has been designed by Bendix-Pacific Division to accomplish three major functions: (1) digital to teletype conversion of radar tracking information for teletype transmission to computing equipment; (2) high-speed transmission of radar tracking information to computing equipment; (3) preparation of telemetry and time information for transmission to computing equipment.

The digital to teletype conversion equipment is provided at all sites listed in Table I-3, except the Computing Center. At Cape Canaveral, Bermuda, and the demonstration site, high-speed data transmission is provided. Equipment for the accomplishment of the third function is provided at Cape Canaveral and Bermuda only.

4-2. DIGITAL-TO-TELETYPE CONVERSION SUBSYSTEM

A. GENERAL

The Project Mercury digital-to-teletype conversion equipment accepts, converts, and provides a means to transmit capsule tracking information to the computing center in the form of teletype signals. Radar signals are received from the capsule by S-Band (Verlort or MPQ-31) and C-Band (FPS-16) radars located at the Project Mercury ground instrumentation sites (Table I-3). The digital output from both radars is converted to teletype signals at the Milgo 165 Converters. Also, the teletype signals are time identified at the

converters. Time identified teletype signals from the converters are then selected for transmission to the teletype sending line at the Radar Data Control Unit. Refer to Section VI for site block diagram presentation. Ground instrumentation sites utilizing both Verlort and FPS-16 radars are furnished with Radar Data Control Unit (dual). Sites employing one radar are furnished with Radar Data Control Unit (single). See Table I-1 for site identification and paragraph 1-3C for description of Radar Data Control Units. By omitting the FPS-16 selection and indication features, the following discussion applies to ground instrumentation sites employing the Radar Data Control Unit (single). The Eglin unit differs as noted in the discussion.

B. CONVERTER INPUTS

Inputs to the converters are derived from two sources; the time generator and the FPS-16, Verlort, MPQ-31 radars or the 36-bit data receiver.

The site time generator supplies the time of day (Greenwich Mean Time-GMT) in the form of 20 parallel bits of hours, minutes, and seconds in Binary Coded Decimal (BCD) to the converter. A second time signal, one pulse every 6 seconds, is also supplied from the time generator.

The FPS-16 radar develops data at the output of its digital processing equipment upon receiving a command from the converter. Two command signals are required to initiate radar data transmission from the radar; strobe pulses which illuminate azimuth and elevation shaft encoders and shift pulses that step data from the radar output registers. The encoders are read once every 6 seconds and the data is shifted out at the rate of 4,000 bits per second. Azimuth and elevation bits are shifted out simultaneously on two coaxial lines and are contained in a series of 17 bits of natural binary code each. The range

data word consists of 20 natural binary bits and is shifted out simultaneously with azimuth and elevation data.

The Verlort radar supplies an output in response to strobe pulses from the conversion system. The strobe pulses cause the azimuth and elevation optical shaft encoders to be read-out directly into the conversion equipment. Azimuth and elevation data each consist of 16 bits of gray code in parallel. Range information is developed from the coarse and fine shaft encoders and appears at the system input as presence or absence of d-c voltages. Gates in the converter admit range data so that it may be synchronized and read with the azimuth and elevation data. Range information consists of 19 gray coded bits in parallel. All radar data is first converted to straight binary, if necessary, then to octal, and finally, encoded into a start/stop teletype signal.

Heading information is developed within the converter and is stored in shift registers in binary. It is necessary to convert binary to a teletype code pattern representing the equipment octal or decimal code number. This is accomplished in a conversion matrix during readout. Decimal conversion is also required for the time information.

C. VALID DATA

In addition to numerical data, each radar will supply a valid data (data acceptable) signal to the converter. The signal is encoded by the converter to indicate to the computers that the data is valid. Two conditions must be met to generate this signal. First, the radar

must be automatically tracking the capsule beacon. The second condition is that the radar must be properly operating to present error-free data at its output. Test for the first condition is automatically made within the radars. The second condition requires the decision of the radar operator who, therefore, will be responsible for initiating the signal. The DATA ACCEPTABLE signal will be removed manually by the operator or will drop out automatically when the radar loses track.

D. CONVERTER OPERATION

(1) GENERAL - The converter output contains radar, time, and heading information arranged into a five-level, stop/start teletype code capable of being transmitted by standard teletype circuits and equipment. The format is shown in figure 4-1. Each character consists of a start space followed by five bits and a stop mark. Characters are formed by marks (line current) or spaces (no line current) according to the Teletype Baudot Code. Characters are generated at a rate of six per second. The speed of transmission is 60 words per minute with six characters representing one word.

(2) DATA FRAME - Upon receipt of a "start" data transmission signal from the Radar Data Control Unit, the converter generates a beginning of message code sequence which makes the teletype sending line ready for data transmission to the Goddard Space Flight Center teletype receivers. The beginning of message code sequence is: J, J, Letters, Carriage Return, Line Feed, Letters. Following the code, a series of data frames is developed. Heading, time, azimuth, elevation, and range comprise a data frame of 34 characters. One frame is transmitted every 6 seconds. The heading contains eight characters which serve to perform necessary functions on page printers such as carriage return, line feed, etc., and to identify the data as to originating station, kind and validity of data, and

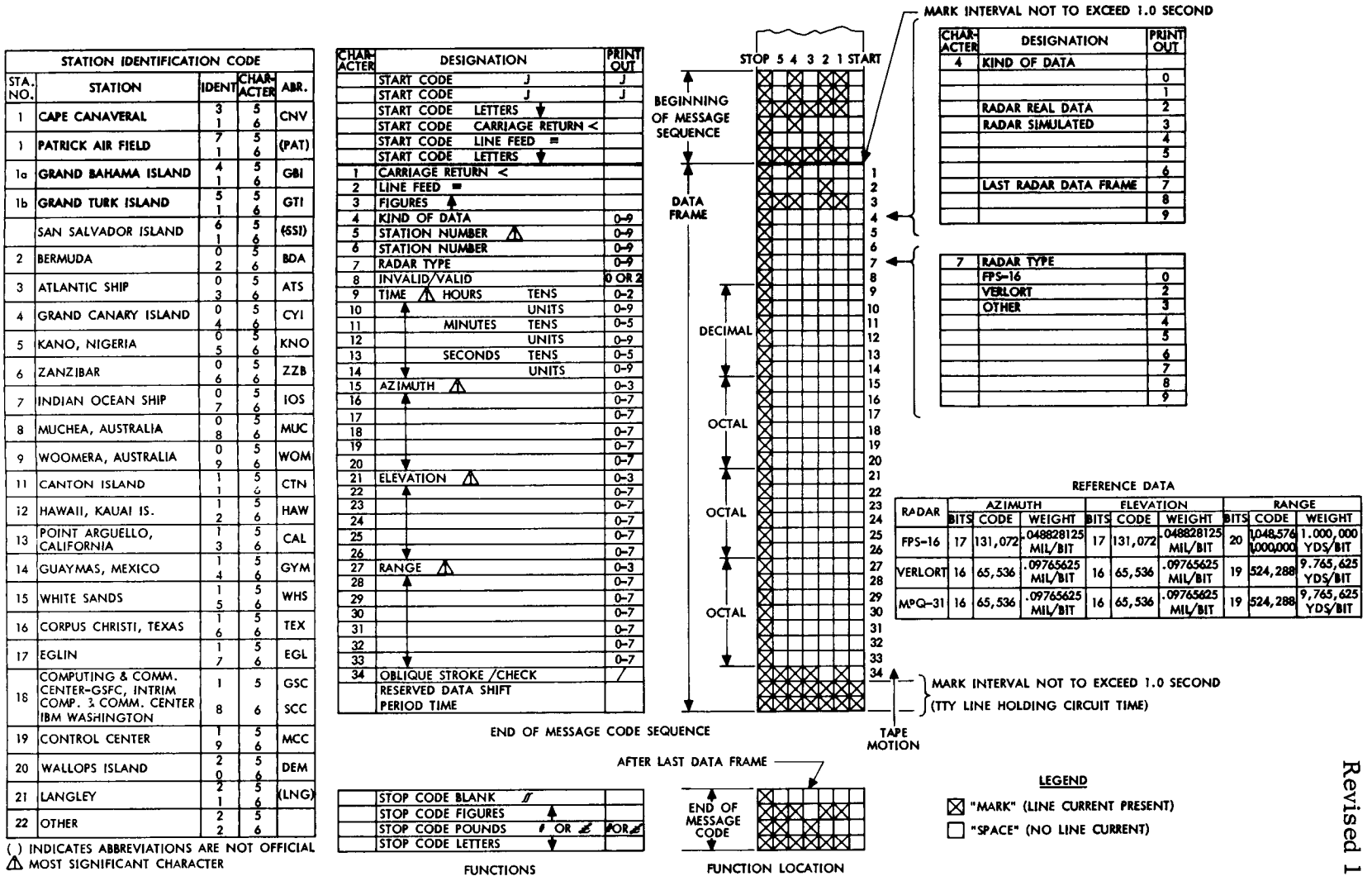


Figure 4-1. Digital-to-Teletype Conversion Subsystem - Teletype Format

radar type. Following the heading, six characters print out time directly in hours, minutes, and seconds. Azimuth and elevation data take up six characters each and print out octal coded numbers. Range data occupies the next seven characters with octal print-out resulting. The thirty-fourth character is an oblique stroke which completes the 34-character data frame.

The data frames repeat every 6 seconds until both radars have lost the capsule. When the radars lose the capsule beacon signal, a "stop" transmission signal is sent from the radar data control unit to the converters which then send an end-of-message sequence. The sequence is: Blank, Figures, #, Letters.

(3) CONVERTER OUTPUTS - Two separate teletype outputs are provided from each converter. The purpose of one output is to feed the sending side of a full duplex teletype sending circuit. The second output terminates in a Teletype Receiving Only Reperforator (ROTR) located in the site control center. The line current supply for the local circuit is located at the control center. Separation of the converter outputs and provision for a local supply assures preparation of a data tape on the ROTR, regardless of faults in the transmission circuit. ROTR tapes will be used for retransmission of data or for post flight analysis. Retransmission is accomplished by inserting applicable punched ROTR tapes in a tape reader. The tape reader is included in a Teletype Automatic Send/Receiver Set (ASR) which is part of the complement of teletype equipment at the sites. To produce a permanent record of site data transmissions, a ROTR, equipped with a large capacity tape supply and take-up reels, is connected to the outgoing teletype line. Monintoring of site transmissions, including errors and local transmission failures occuring during transmission to the Goddard Space Flight Center, will then be possible. A Receiving Only (RO) page printer is connected to the converter to check the

operation of the radar data conversion process during tracking operations. It is also necessary to test radar output and converter operation in boresighting and self-checking procedures. During such tests, the two teletype outputs of the converter will be blinded by shorts to prevent test signals from reaching the teletype transmission circuit or the ROTR riding the second output of the converter.

4-3. SELECTION AND TRANSMISSION OF TELETYPE DATA

A. GENERAL

The following information describes the operation of dual sites employing two radars and two converters and of single sites utilizing a single radar and one converter. One difference exists, however, in the operation of these sites in that the Radar Data Control Unit for the single site does not employ the controls and indicators necessary for the selection and control of two converter outputs. See Table I-3 for identification of dual and single sites.

B. RADAR DATA CONTROL UNIT OPERATION

Outputs from the two converters are selected and controlled by the Radar Data Control Unit which functions to permit transmission, or no transmission, of information from either radar to the teletype sending line. The selector control is synchronized to the timing pulse which controls generation of the teletype signal in the converter. When switching from one radar to the other, transfer takes place at the end of the transmitting data frame. This feature results in no loss of data due to the switching process. Two controls on the Radar Data Control Unit start and stop transmission from the converters. When the TRANSMIT control is operated and after the necessary delays, three simultaneous actions take place in the following sequence: (1) the ASR set is disconnected from

the teletype line to prevent interruption to radar data transmission; (2) the blind is removed from the line output of the radar selected; and (3) the converter is placed in operation. Operation of the STOP control reverses the operation with the necessary time delays synchronized to site timing. Upon receipt of a stop transmission command, the converter transmits a complete data frame and adds the four character end-of-message code sequence. The Radar Data Control Unit contains circuits which provide a time delay sufficient to permit transmission of the remaining part of the last data frame and the 1/2 second end-of-message code sequence. After transmission of these signals, the radar teletype line output is blinded and the ASR set is connected to the sending line.

Most likely the Verlort radar will receive the capsule signal before the FPS-16 radar because of the long range and greater look angle of the Verlort. For this reason the selector control will normally be in the VERLORT position during initial acquisition. During the time the radars are attempting acquisition, the TRANSMIT control will be operated. The converters will generate the beginning of message code sequence followed, within 0.4 seconds, by data frames. The first series of data frames will be identified by the validity character in the teletype message as invalid until the radar acquires the capsule beacon and the radar operator is satisfied that the radar is operating with minimum error. When these two conditions are met, the DATA ACCEPTABLE control will be depressed by the radar operator to produce a valid data character in the teletype data frame, and energize the VERLORT DATA ACCEPTABLE indicator at the Radar Data Control Unit.

When the FPS-16 radar acquires the C-Band signal, the FPS-16 radar operator will activate the FPS-16 DATA ACCEPTABLE control as soon as the required conditions have been established. The

teletype operator, upon observing the FPS-16 DATA ACCEPTABLE indicator on the Radar Data Control Unit, may transfer the teletype sending line to the FPS-16 output even though the Verlort radar may still be on track. This is desirable because the FPS-16 is capable of more accurate short range tracking than the Verlort. As the capsule continues the flight, the FPS-16 will probably lose the target before the Verlort. Loss of the target will extinguish the FPS-16 DATA ACCEPTABLE indicator at the Radar Data Control Unit. The operator may then switch the teletype output to the Verlort until it too loses the capsule. The STOP control will then be operated to sign-off data transmission by an end-of-message code sequence and to stop teletype data transmission from the converters.

An alternate tracking method is to transmit information from only one (Verlort or FPS-16) radar throughout the tracking sequence. After the pass, the punched tape generated by the other radar data may be placed on the teletype sending line for transmission.

Teletype data start and stop controls at the Radar Data Control Unit will start and stop transmission from the converters at both radars simultaneously. This control is important for two reasons. One is that tapes produced by each ROTR will prepare complete messages suitable for retransmission. Both tapes will contain the start and stop code sequence and all data developed by the radar between the sequences. The second reason for control of both radars is that a start and stop code is transmitted on the teletype circuit to Goddard, regardless of which radar is selected. It may be that one of the radars is not capable of developing data, in which case either converter must be able to start and end a message on the sending line.

In addition to the radar selector control, the start/stop controls, and data acceptable indicators, the Radar Data Control Unit

employs converter output indicators. During the acquisition phase of the mission, when tracking operations are imminent, the indicators will light constantly indicating that the converters are at rest and circuits are normal. A flashing light indicates that teletype codes are being developed in the converters and supplied to the sending line. The absence of illumination indicates trouble in the circuit. The indicators operate from line current and serve to indicate to the operator the condition of the circuits. Before the selector control is operated, or before transmission is initiated, illuminated output indicators will assure the operator that he is not switching into a dead sending circuit.

4-4. HIGH-SPEED DATA TRANSMISSION SUBSYSTEM

A. GENERAL

Real time, high-speed transmission of radar tracking information is provided at Cape Canaveral and Bermuda. Since the operational requirements for the two sites are different, a separate description for each site is presented.

B. BERMUDA

(1) GENERAL - High speed data transmission equipment at Bermuda (figure 6-2) consists of two data transmitters, two Milgo data receivers, and a tape recorder/reproducer.

(2) OPERATION - Digital information from FPS-16 and Verlort radars is accepted and translated into tone-coded digital signals by the data transmitters. The data is then transmitted over voice quality lines to the two data receivers where it is converted to match the input of an IBM Data Communication Channel (DCC). The data transmitters also accept time (GMT) signals from the site time generator for transmission to the computer. The tape recorder/reproducer is controlled by the receivers and monitors all valid information for a permanent record.

C. CAPE CANAVERAL

A data receiver is provided at Cape Canaveral (figure 6-1) to prepare information from two FPS-16 radars and one XN-2 radar for application to a digital-to-teletype converter.

4-5. PREPARATION OF TELEMETRY AND TIME INFORMATION SUBSYSTEM

A. GENERAL

At Bermuda and Cape Canaveral buffers are provided to prepare telemetry and time information for transmission to computing equipment.

B. BERMUDA

The Bermuda ground instrumentation site (figure 6-2) employs a Telemetry/Event Buffer (TLM Buffer). The purpose of the TLM Buffer is to arrange the continuously monitored relay contact closures from the Capsule Clock Cabinet CET/TORF Relay Out-Put Assembly and telemetry display equipment into a format acceptable to the IBM Data Communication Channel (DCC). The information is applied to the DCC in response to asynchronous pulses from the computer. The 64 inputs to the TLM Buffer consist of eight telemetry inputs, eight telemetry manual override (reversals) inputs, one manual "Abort Command", and 40 Capsule Elapsed Time (CET) and Time of Retro Fire (TORF) inputs, plus seven spares.

C. CAPE CANAVERAL

The Telemetry/Event Transmitting Buffer (T/E Buffer) utilized at Cape Canaveral (figure 6-1) consists of two buffer units and two power supplies. The T/E Buffer accepts data in parallel from the Fine Monitor CET/TORF Relay Output Assembly and the telemetry event equipment and arranges the data in to a format acceptable to transmitting equipment located in the G. E.-Burroughs and IP-709 Buildings. Both buffer units receive data information from 44 Fine

Monitor output lines and 26 telemetering display output lines. The buffer outputs are then serially transmitted to the transmitting equipment.

SECTION V
MAINTENANCE

5-1. GENERAL

Periodic equipment maintenance will be a prime factor in overall system stability after initial installation. This section contains preventive maintenance procedures and instructions for the performance of troubleshooting. All instructions provided in this section apply to each of the three digital data processing subsystems.

5-2. PREVENTIVE MAINTENANCE

A. INSPECTION PRIOR TO OPERATION

The following procedures should be performed before each test or active operation to insure effective operation of the three subsystems.

(1) Inspect all controls and switches for proper operation. Tighten loose knobs and repair or replace items which indicate faulty mechanical operation.

(2) Visually inspect all indicators and fuses; replace defective items. If power fuses fail following replacement, refer to the applicable equipment handbook listed in Table I-2 and perform procedures as required.

B. PERIODIC CHECKS

The preventive maintenance schedule contained in Table V-1 lists the various checks to be performed, the type of service required,

and the time interval between inspections. Each unit of equipment comprising the system should be inspected with respect to the applicable checks listed in the table.

TABLE V-1. PREVENTIVE MAINTENANCE SCHEDULE

		TIME INTERVAL					
		Before Operation	During Operation	After Operation	Daily	Weekly	Monthly
ITEM	REQUIRED SERVICE						
Cabinets	Inspection and cleaning					X	
Equipment Chassis	Component checks and cleaning					X	
Chassis Slides	Inspection and cleaning					X	
Front Panels	Inspection				X		
Blowers	Filter cleaning						X
Connectors	Inspection and cleaning					X	
Chassis Wiring	Inspection					X	
Chassis Components	Inspection					X	
Electron Tubes	Inspection	X					
Indicators	Inspection	X	X				X
Fuses	Inspection	X	X				

Items determined to be faulty should be repaired or replace as necessary. The following procedures should be considered when performing the preventive maintenance inspections and checks detailed in Table V-1.

(1) INSPECTION AND CLEANING - Dust and foreign matter should be removed from the cabinets and equipment chassis with the use of a vacuum cleaner. Extreme care should be exercised to prevent damage to components and plug-in modules during the cleaning operations.

(2) FRONT PANEL INSPECTION - All controls, indicators, meters, switches, and jacks should be inspected for loose mountings, broken insulators, and signs of dirt.

(3) COMPONENT AND WIRING CHECKS - All components contained in the individual equipment chassis should be checked for evidence of overheating, faulty connections, and loose mountings.

(4) FILTER CLEANING - The air filters used in the cabinet blowers should be removed and cleaned approximately every two weeks, or when visual inspection shows that shorter intervals are required. The filters should be flushed with hot, soapy water, and thoroughly rinsed and dried.

5-3. TROUBLESHOOTING

Because the three subsystems comprising the digital data processing system individually contain relatively few items of equipment, subsystem troubleshooting consists principally of localizing malfunctions within individual cabinets. Detailed troubleshooting procedures for each item of equipment are contained in the applicable handbook

which is referenced in Table I-2. If, however, the malfunction is such that it cannot be localized within the subsystem to a specific item of equipment, performance of the applicable subsystem pre-operational test procedure detailed in Section III of this handbook should be performed. Reference to the applicable site block and wiring diagrams contained in Section VI will facilitate the subsystem troubleshooting process. After the defective equipment item has been isolated, troubleshooting procedures contained in the applicable operation and maintenance manual may then be performed. Whenever an equipment item within a particular subsystem has been repaired, adjusted, or replaced with component parts, the pre-operational test procedure should again be performed.

5-4. REPAIR AND LUBRICATION

Instructions for the repair and lubrication, when applicable, of assemblies, subassemblies, and component parts are contained in the individual equipment operation and maintenance manuals (see Table I-2).

5-5. TEST EQUIPMENT LIST

TABLE V-2. TEST EQUIPMENT FURNISHED

ITEM	TYPE	MANUFACTURER AND MODEL NUMBER
A-C Meter	RMS	Ballantine, 320
Voltmeter	Vacuum Tube	Hewlett-Packard, 410B
Function Generator		Hewlett-Packard, 202A
Power Supply	Variable	Power Designs, 105TA
Oscilloscope	Dual Trace	Tektronix, 545A

TABLE V-2. TEST EQUIPMENT FURNISHED (Continued)

ITEM	TYPE	MANUFACTURER AND MODEL NUMBER
Oscilloscope	Plug-In	Tektronix, 53/54 C-A
Probe	Low C	Tektronix P410
Sweep Generator		Telonic, HD-1A
Volt/Ohmeter		Triplett 630 PL

SECTION VI
DIAGRAMS

6-1. GENERAL NOTES

Delta sign △10 on figures 6-1 through 6-6 and delta sign △3 on figure 6-7 indicate the following:

(a) A blind is applied to the permanent record ROTR and the radar teletype transfer relay output when Digital-to-Teletype Converter, Milgo 165 is not transmitting radar data. The WECO relay equipment accomplishes this function in response to the START/STOP controls at the Radar Data Control Unit.

(b) A blind is applied to the ASR teletype set when the converter transmits radar data. The WECO relay equipment also accomplishes this function in response to the Radar Data Control Unit START/STOP controls.

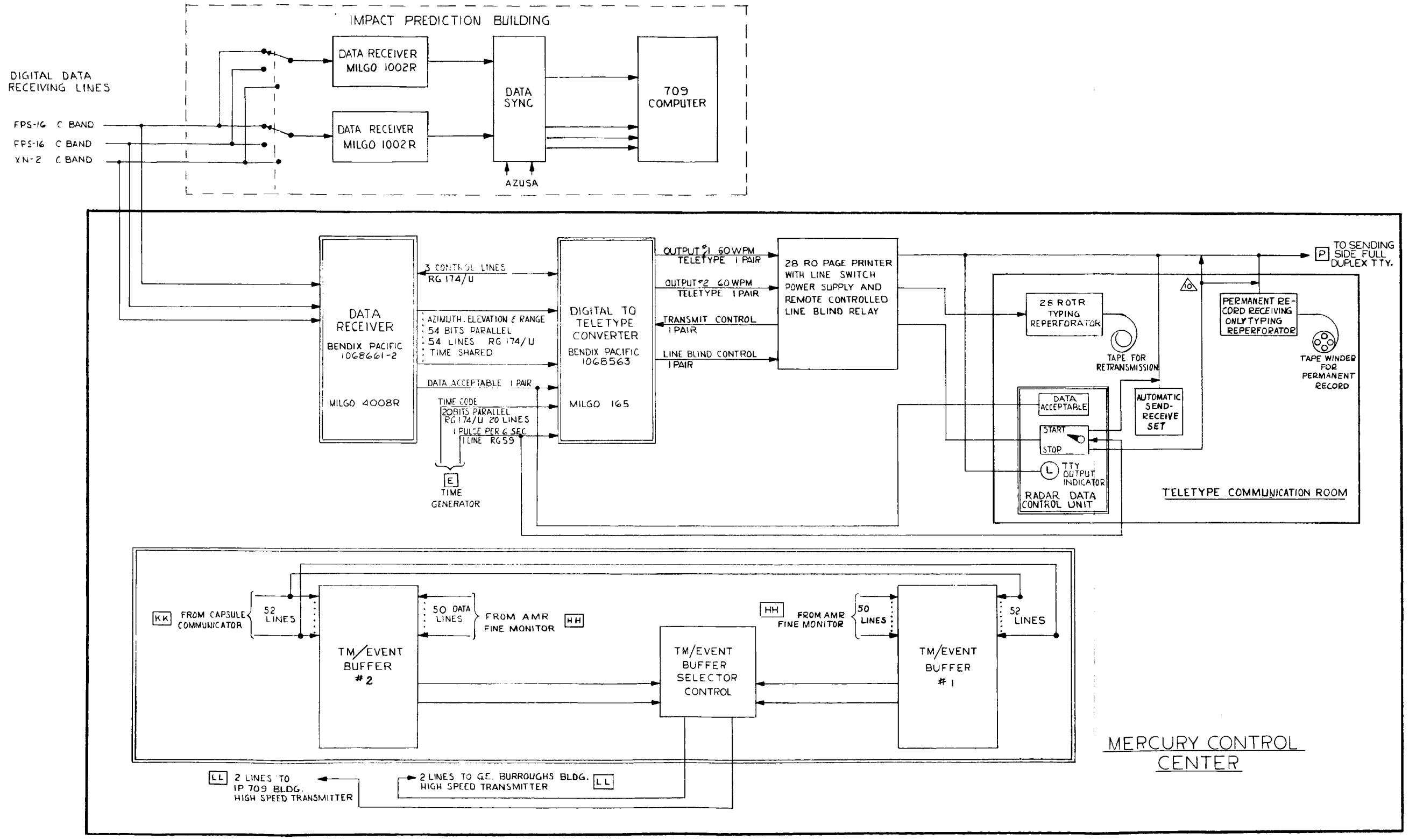


Figure 6-1. Digital Data Processing System - Cape Canaveral Block Diagram

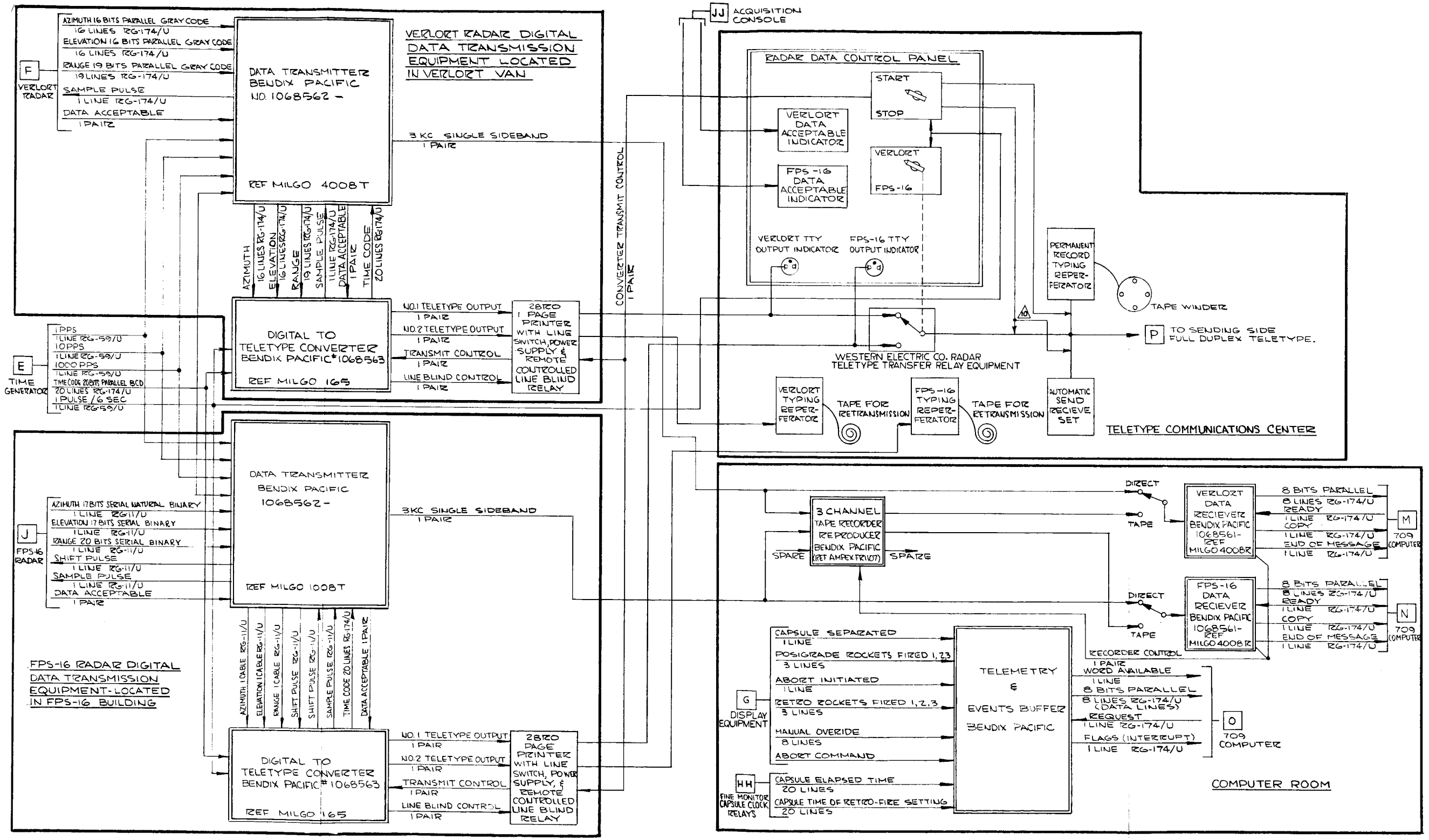


Figure 6-2. Digital Data Processing System - Bermuda Block Diagram

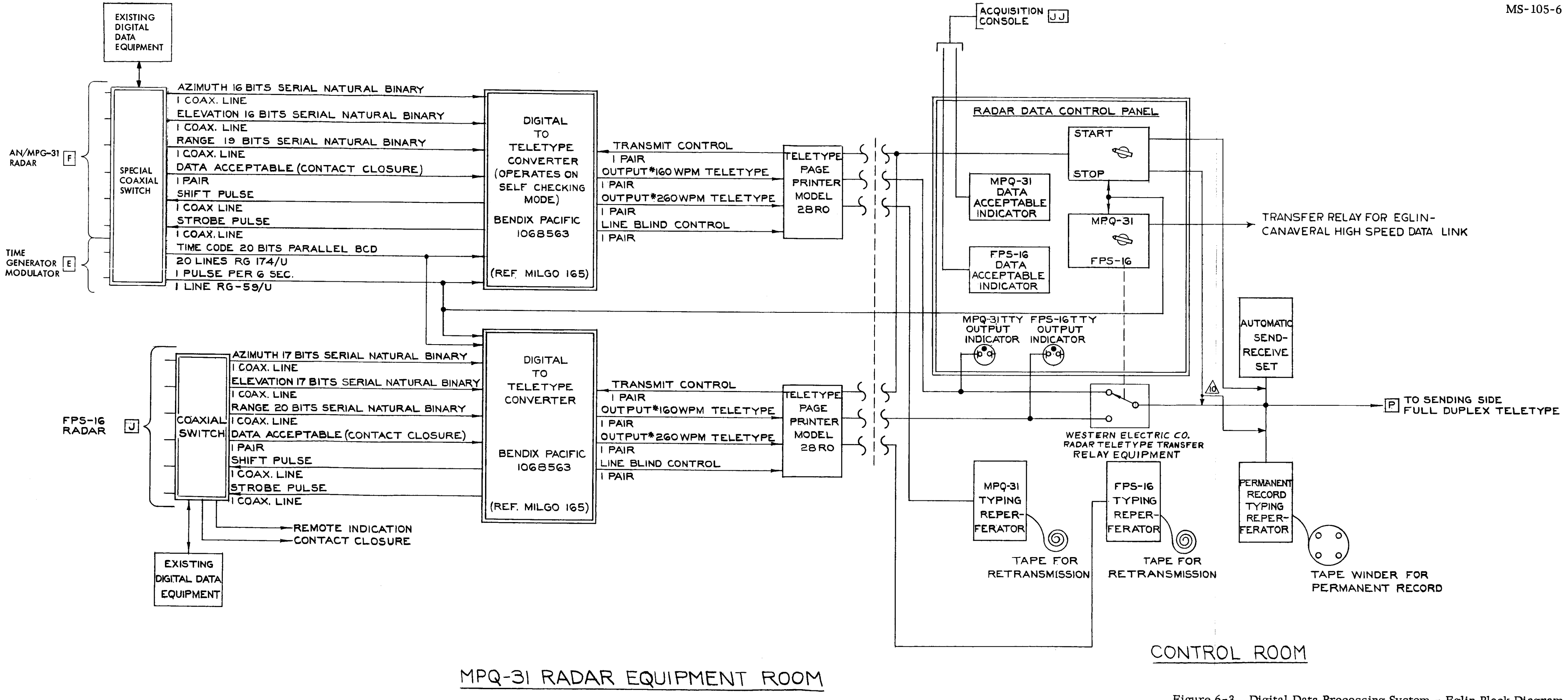


Figure 6-3. Digital Data Processing System - Eglin Block Diagram

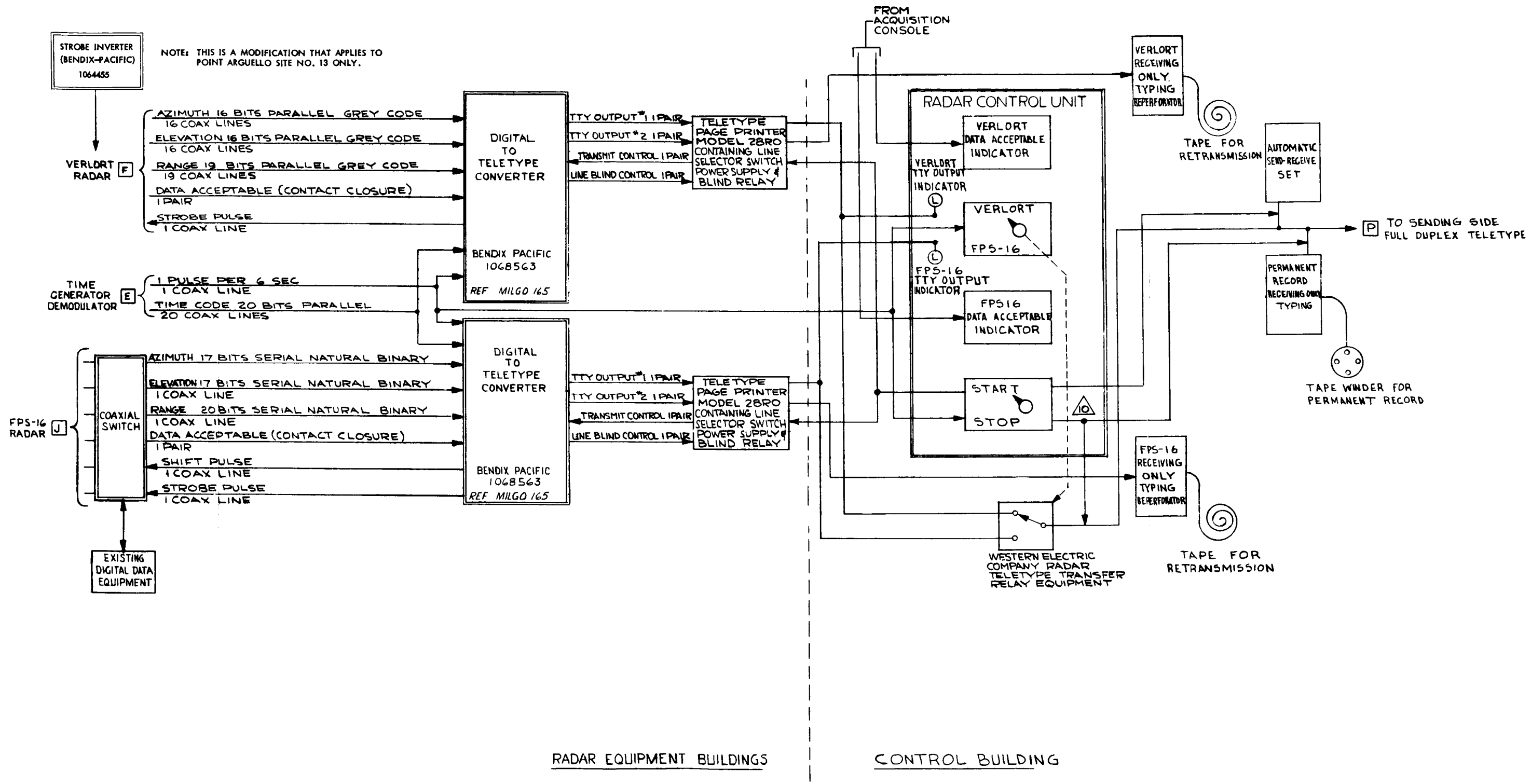


Figure 6-4. Digital Data Processing System - Kauai Island and Point Arguello Block Diagram

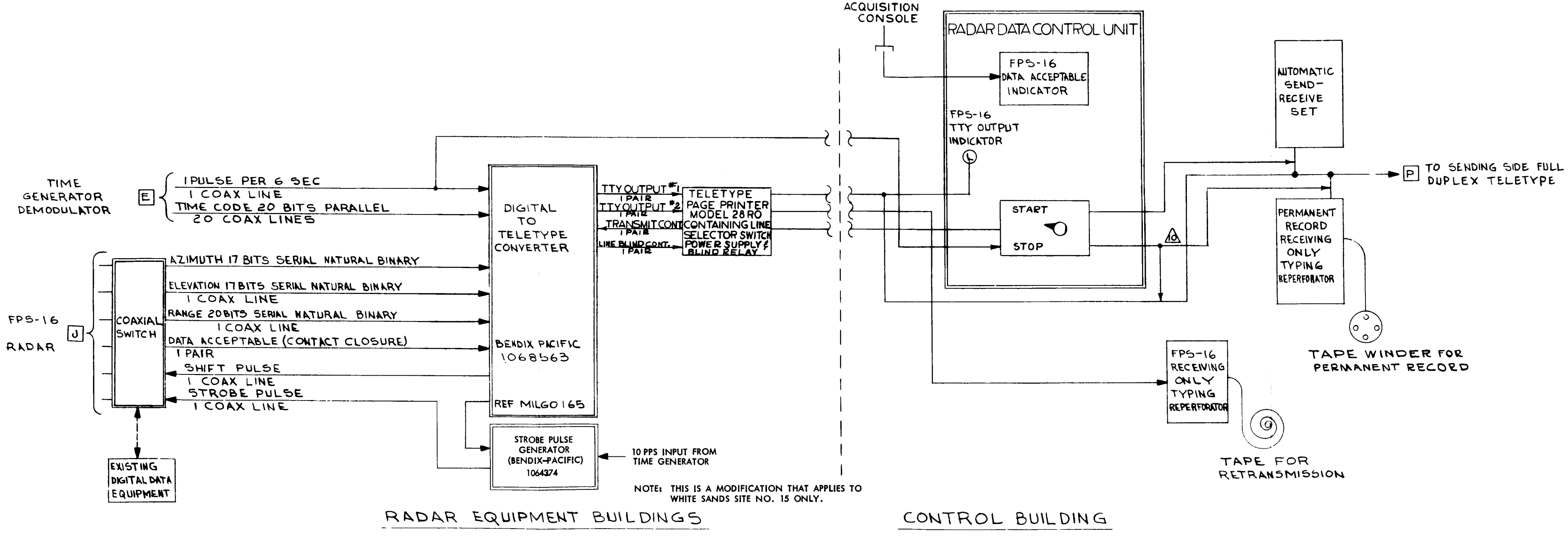


Figure 6-5. Digital Data Processing System - Woomera and White Sands Block Diagram

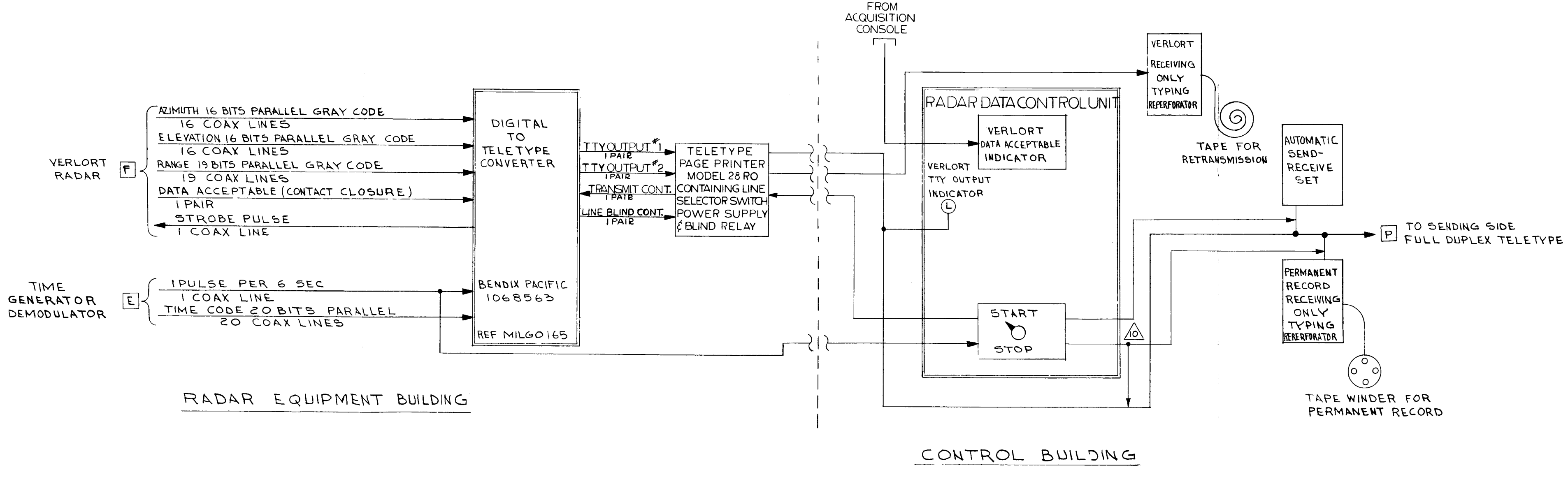


Figure 6-6. Digital Data Processing System - Grand Canary Island, Muchea, Guaymas, and Corpus Christi Block Diagram

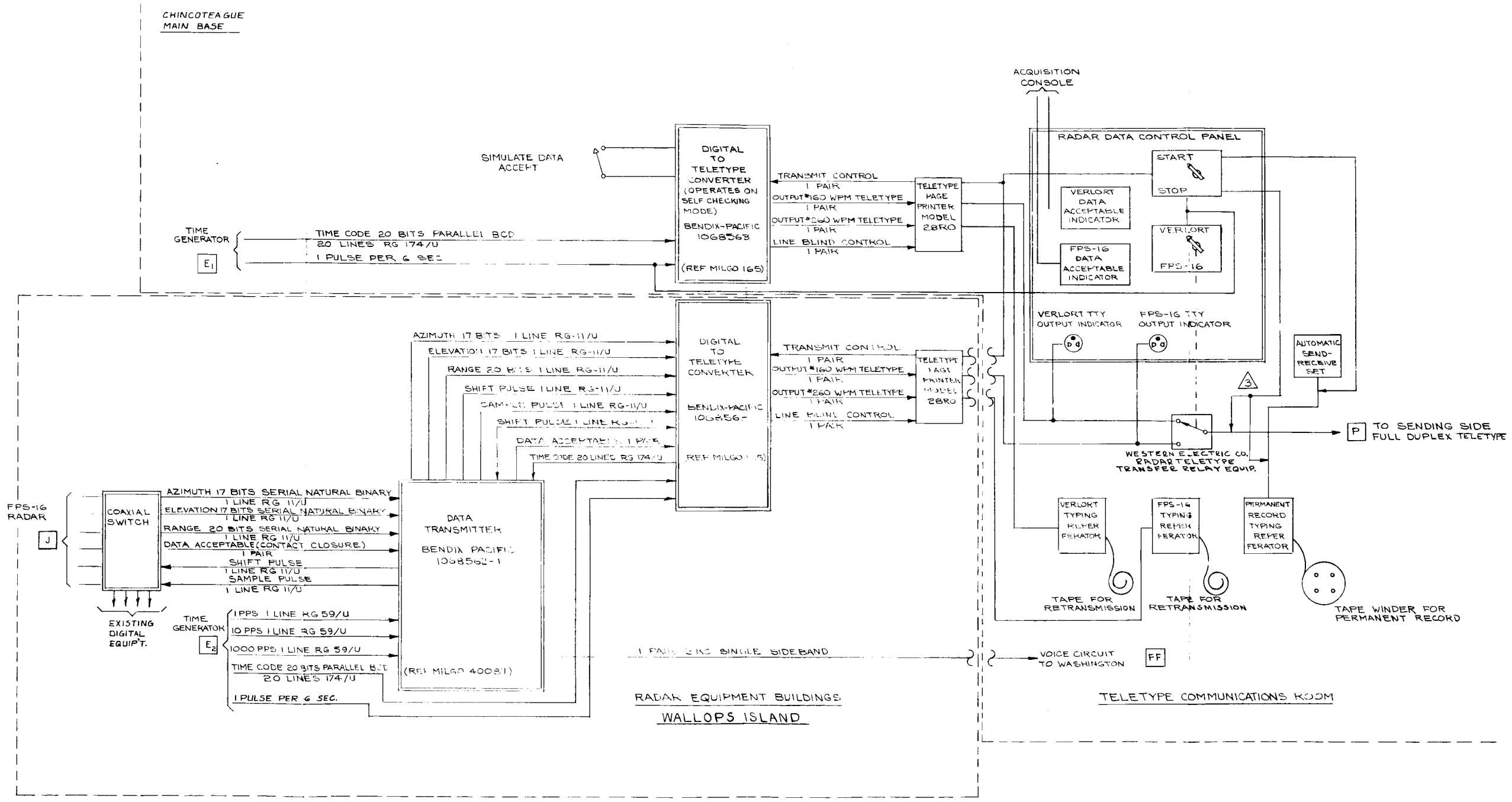


Figure 6-7. Digital Data Processing System - Wallops Island Block Diagram

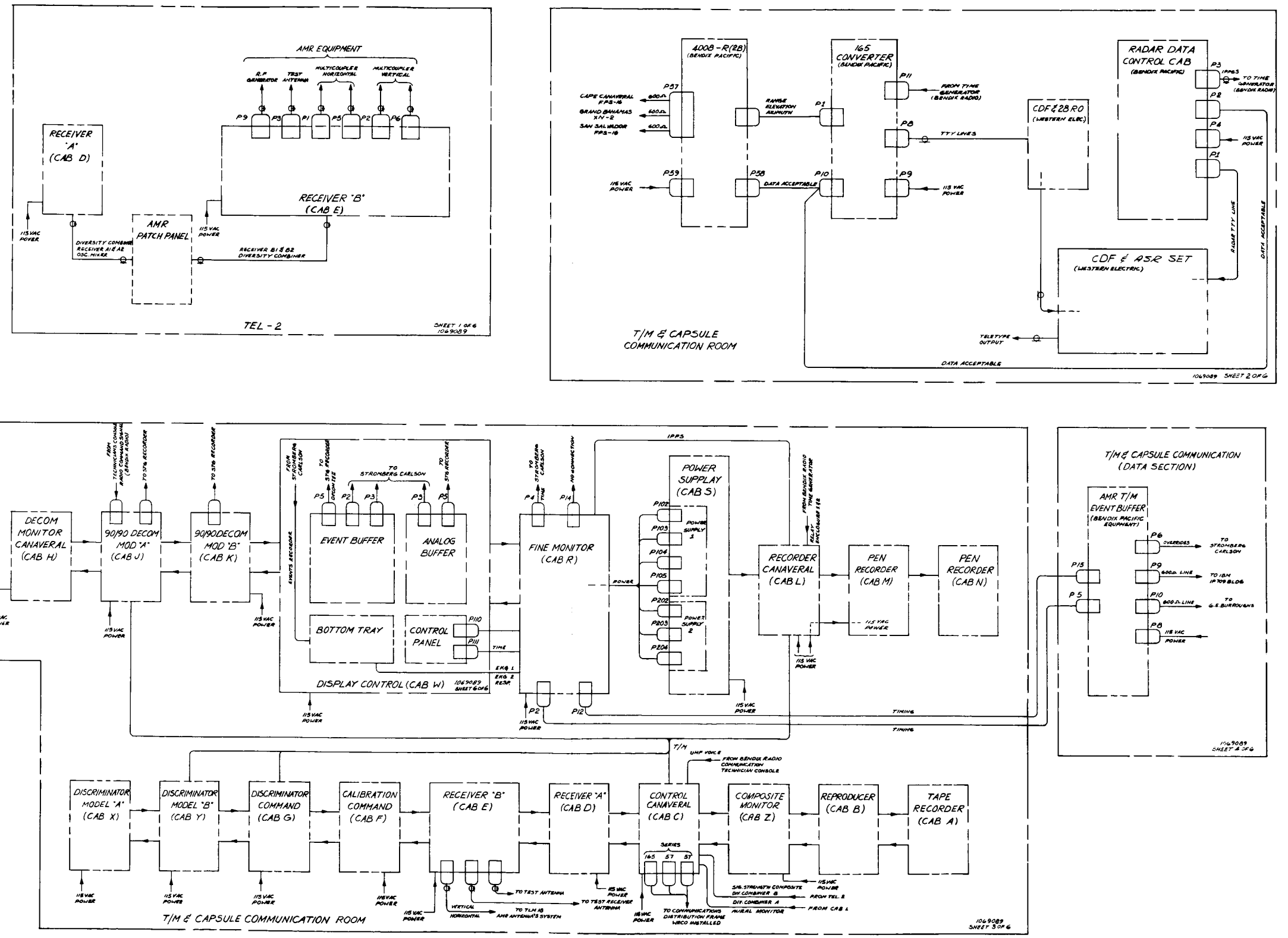


Figure 6-8. Interconnecting Cable Diagram - Cape Canaveral

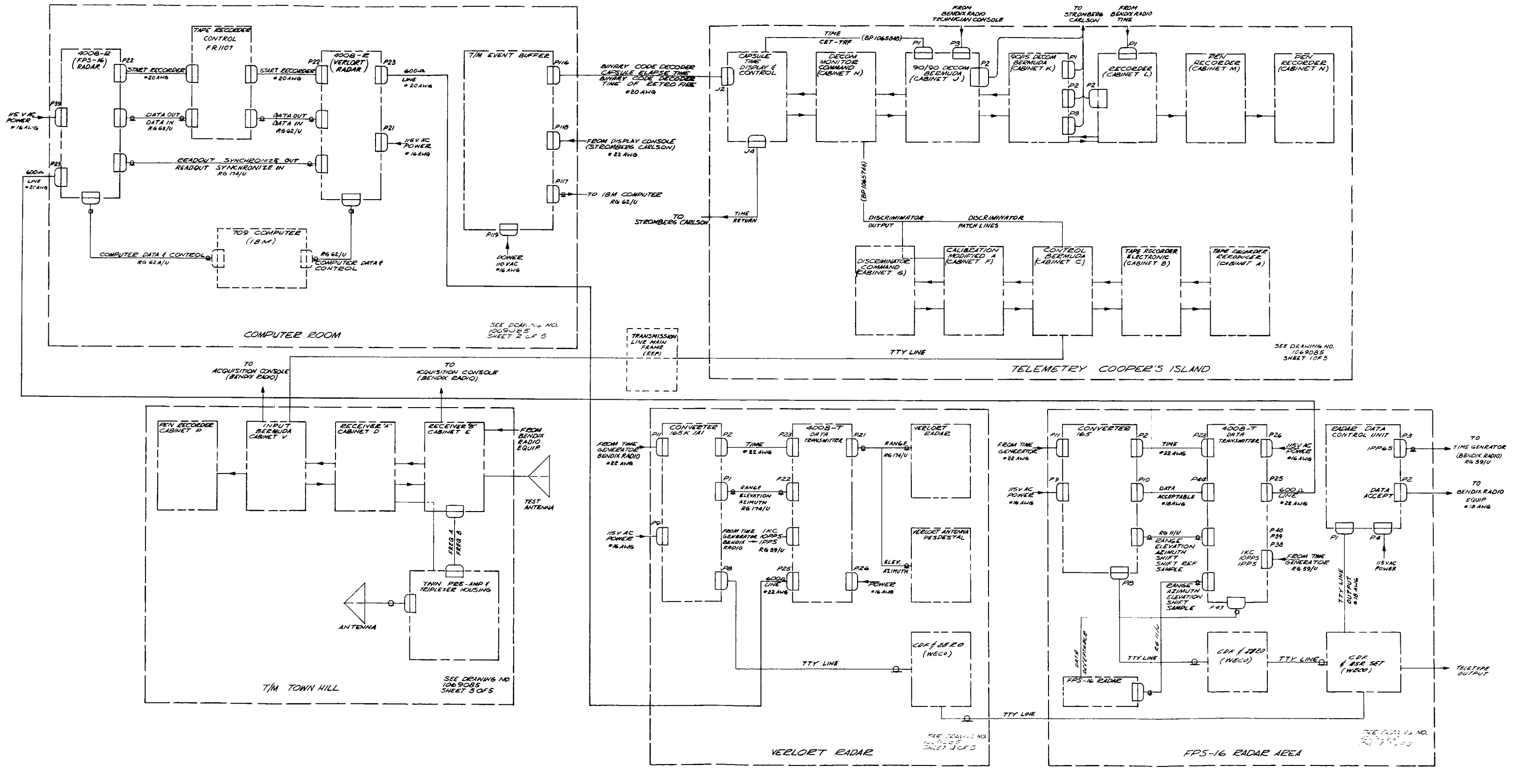


Figure 6-9. Interconnecting Cable Diagram - Bermuda

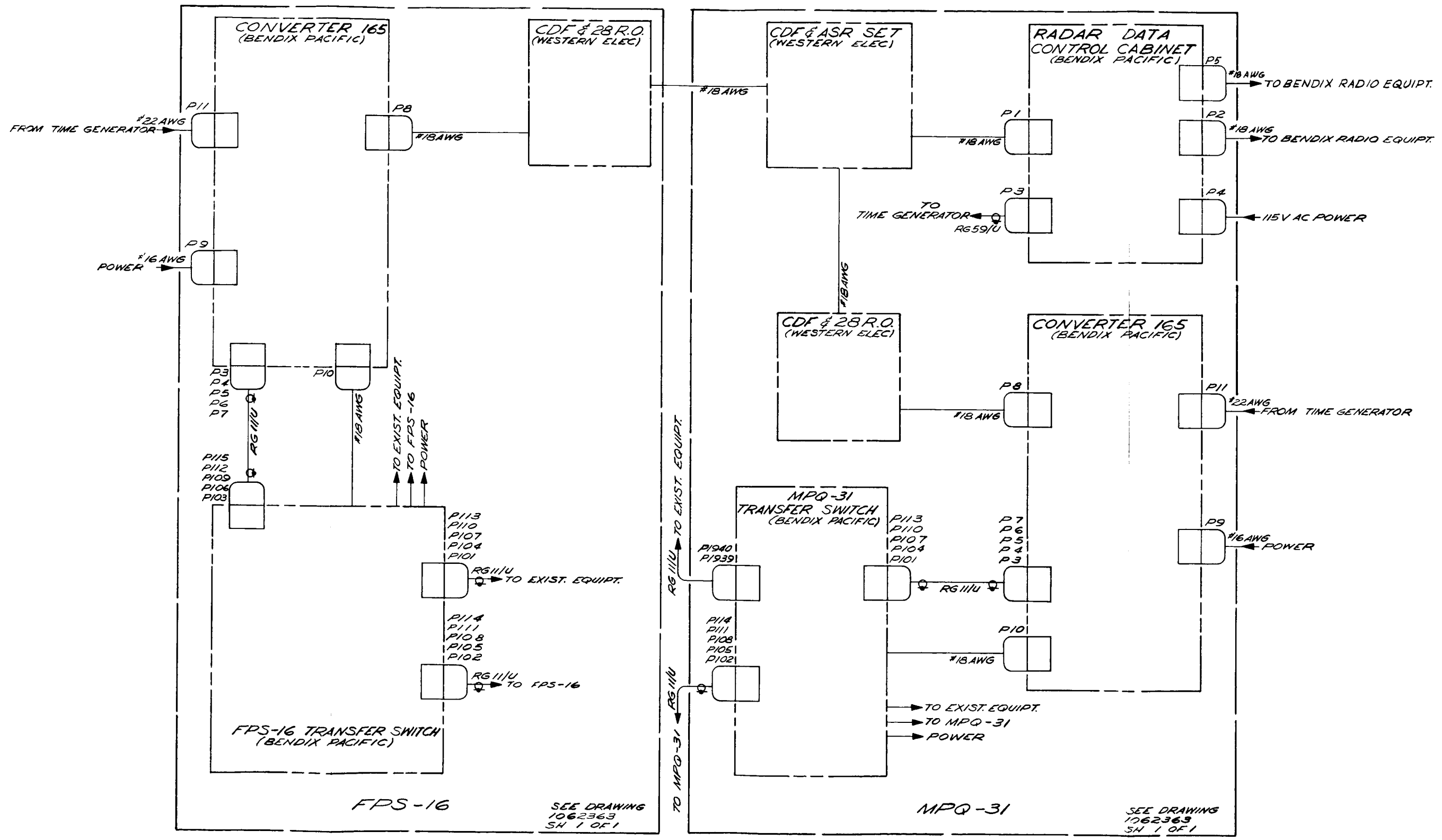


Figure 6-10. Interconnecting Cable Diagram - Eglin

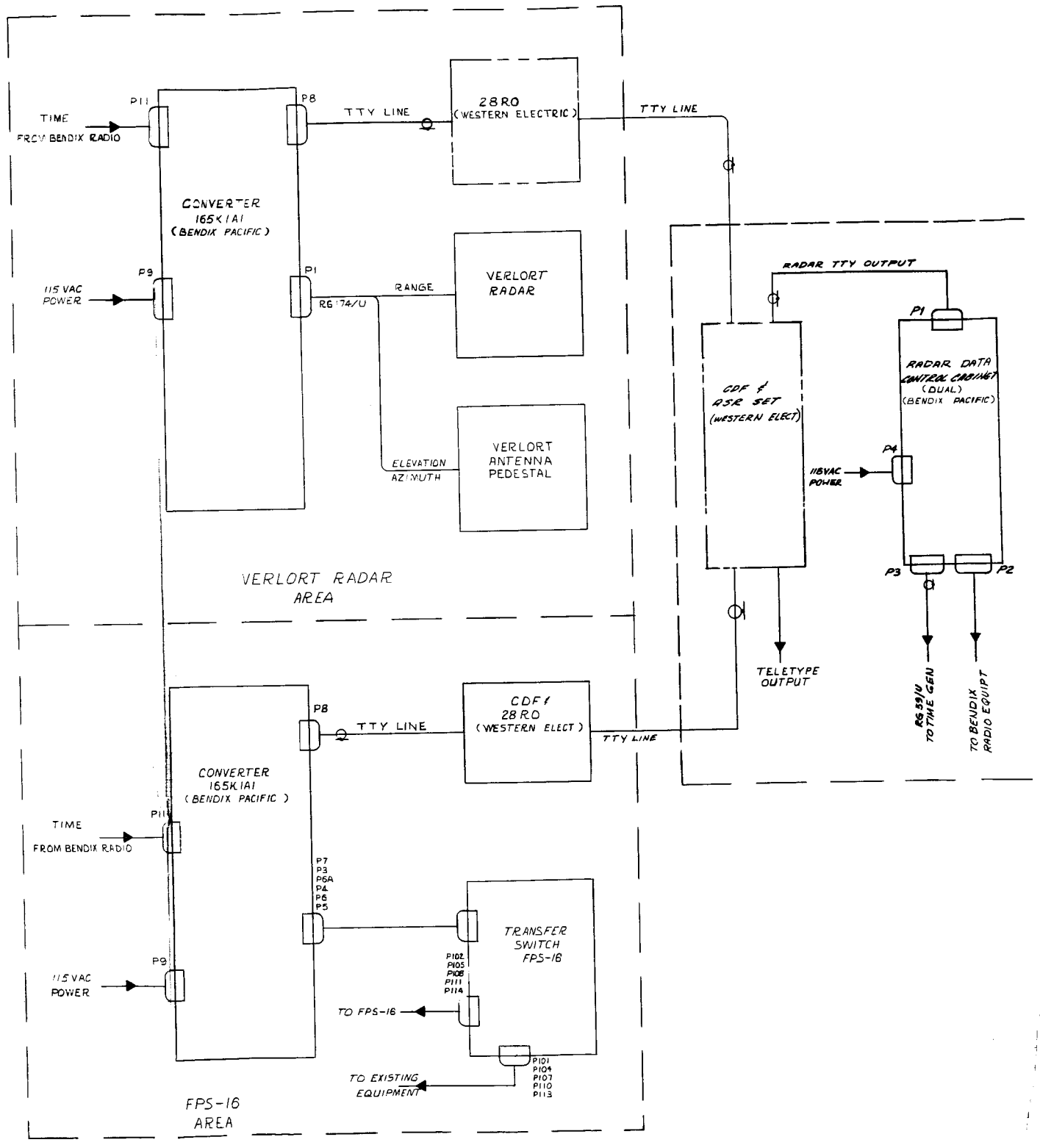


Figure 6-11. Interconnecting Cable Diagram
Kauai Island

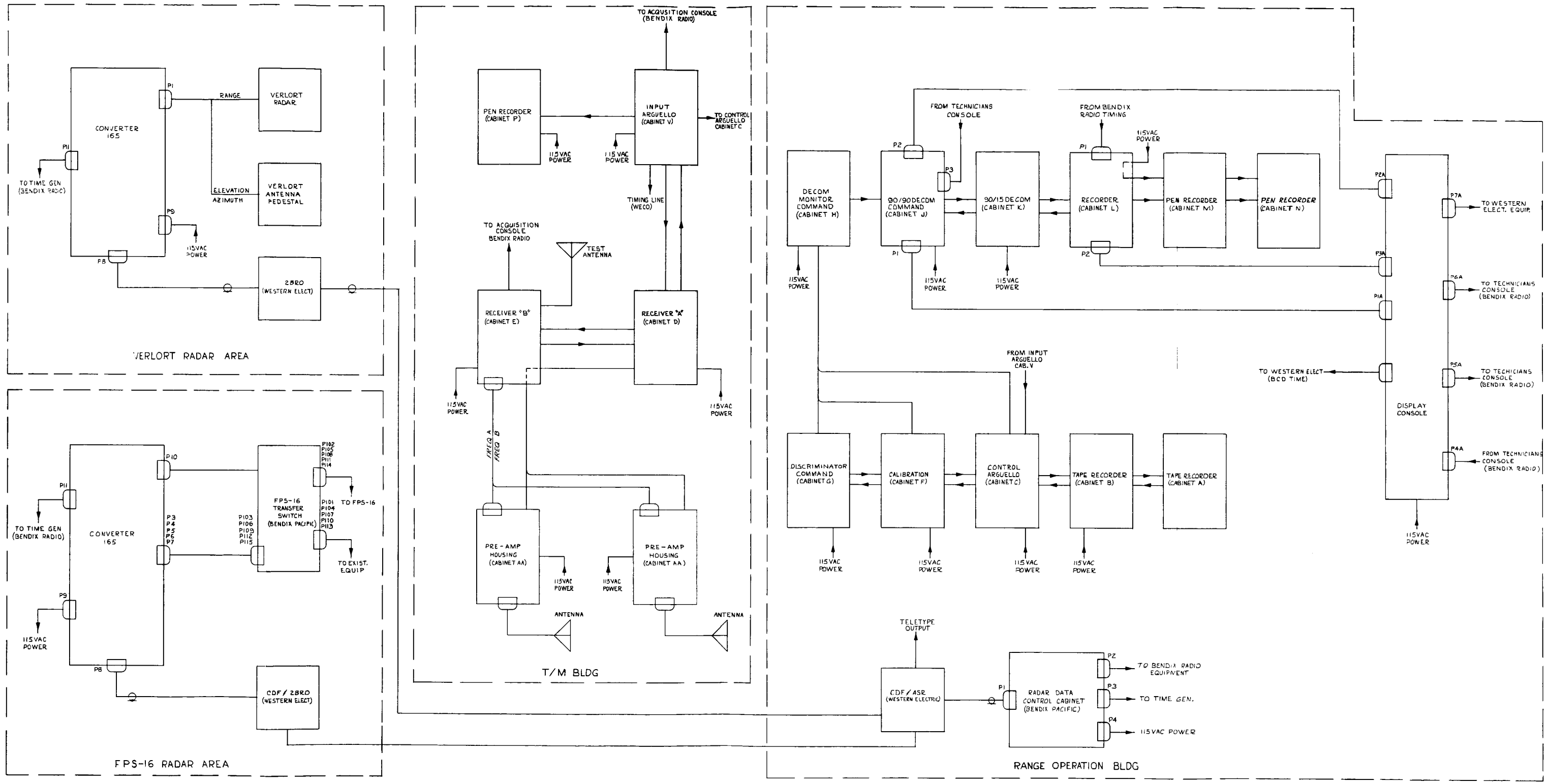


Figure 6-12. Interconnecting Cable Diagram - Point Arguello

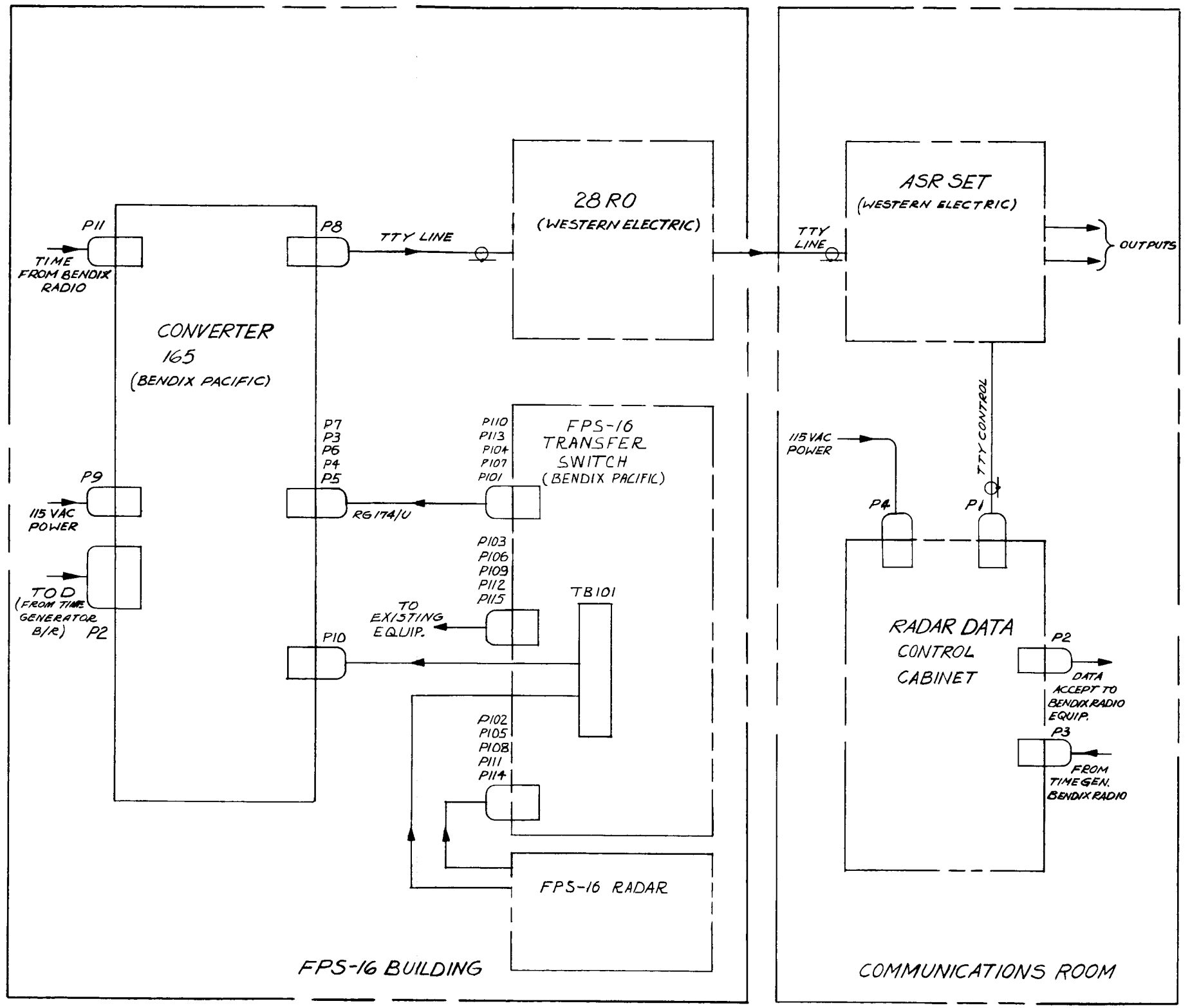


Figure 6-13. Interconnecting Cable Diagram - Woomera

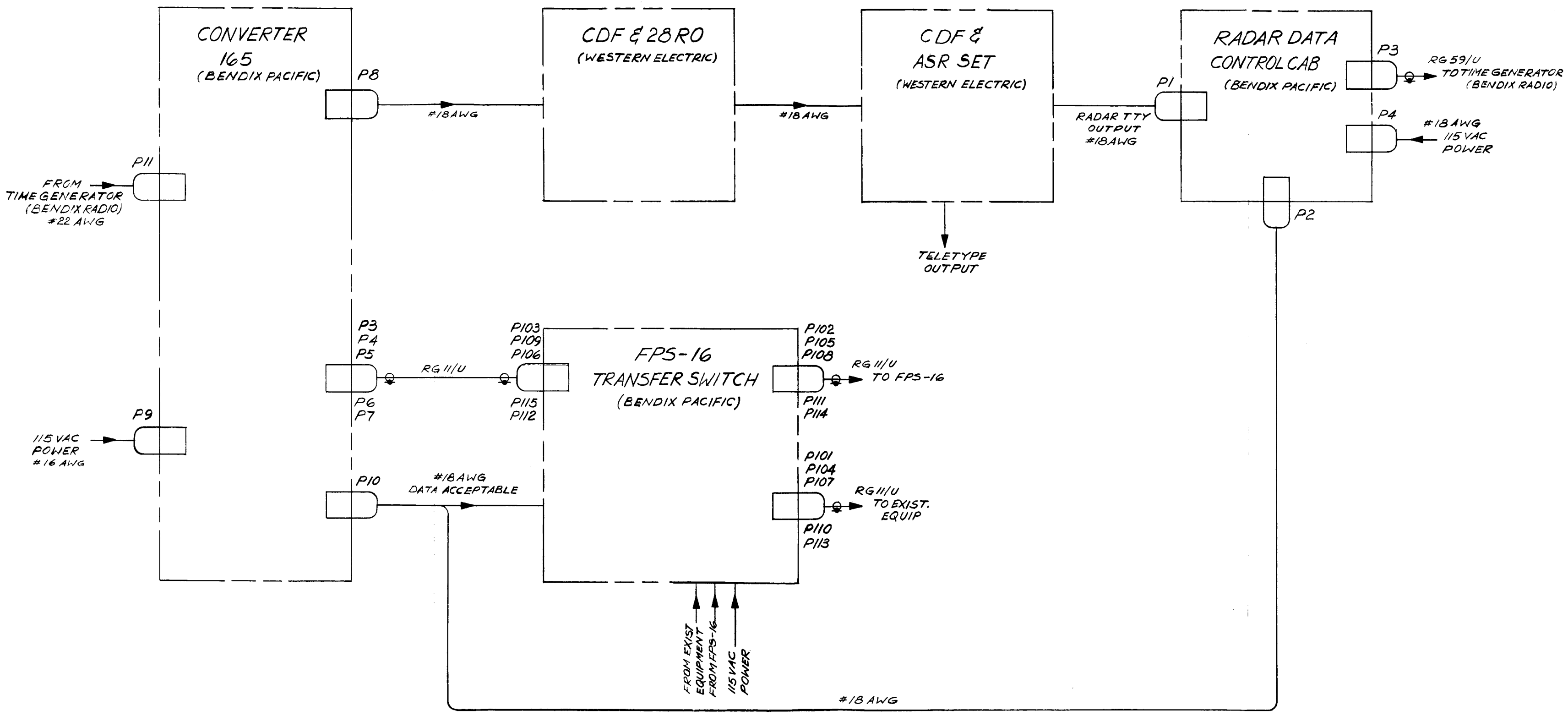


Figure 6-14. Interconnecting Cable Diagram - White Sands

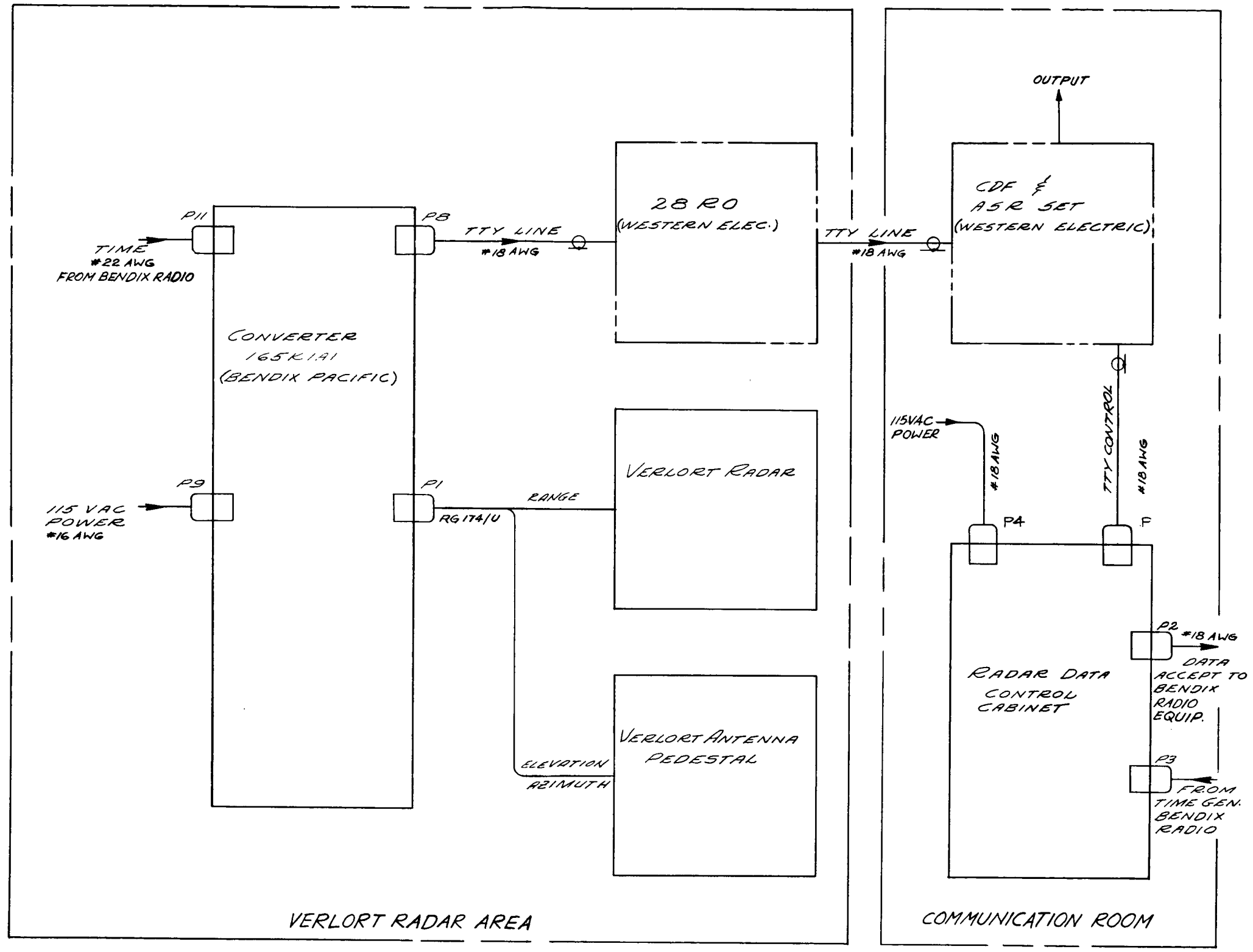


Figure 6-15. Interconnecting Cable Diagram - Grand Canary Island and Corpus Christi

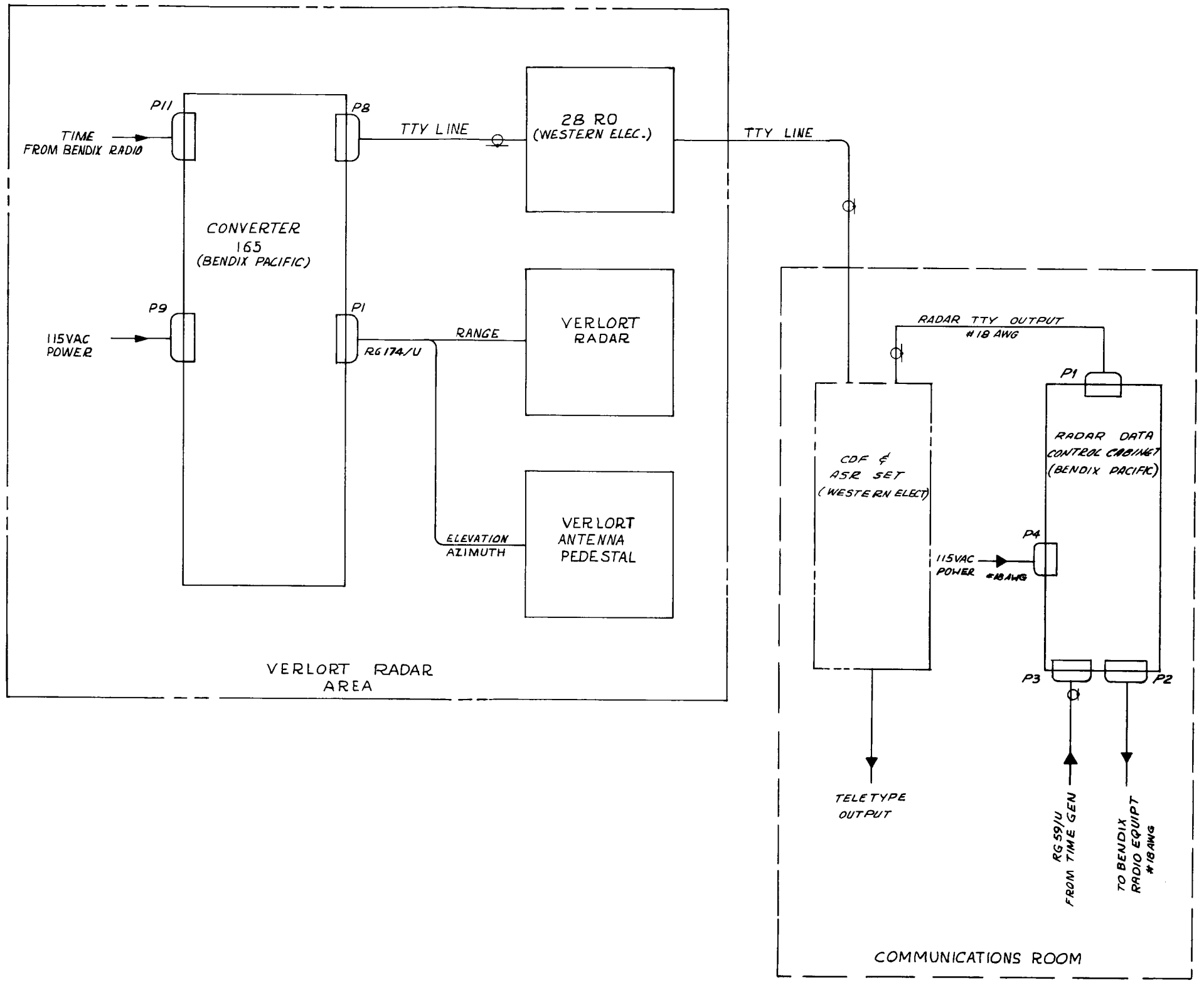


Figure 6-16. Interconnecting Cable Diagram - Muchea and Guaymas

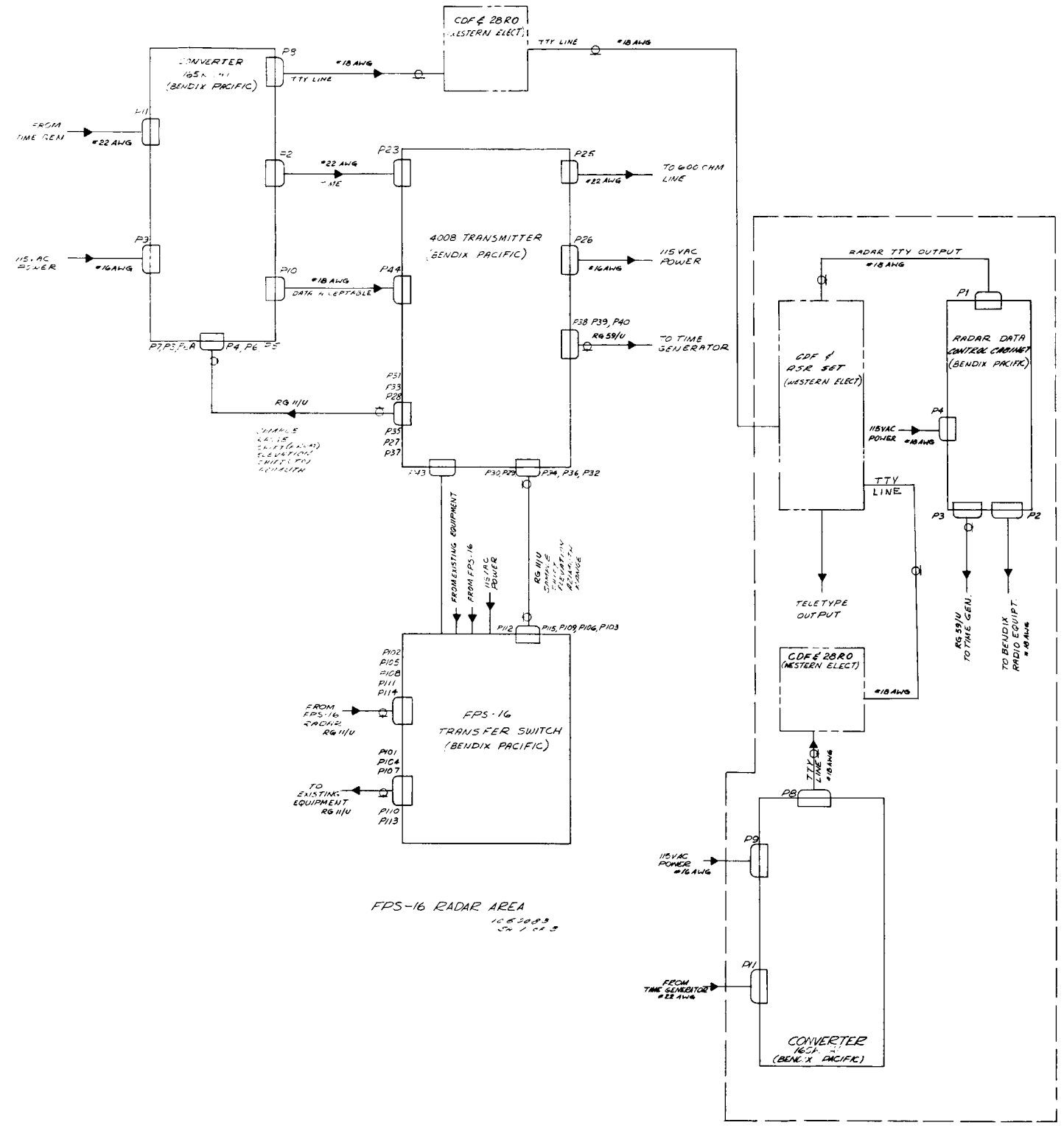


Figure 6-17. Interconnecting Cable Diagram - Wallops Island

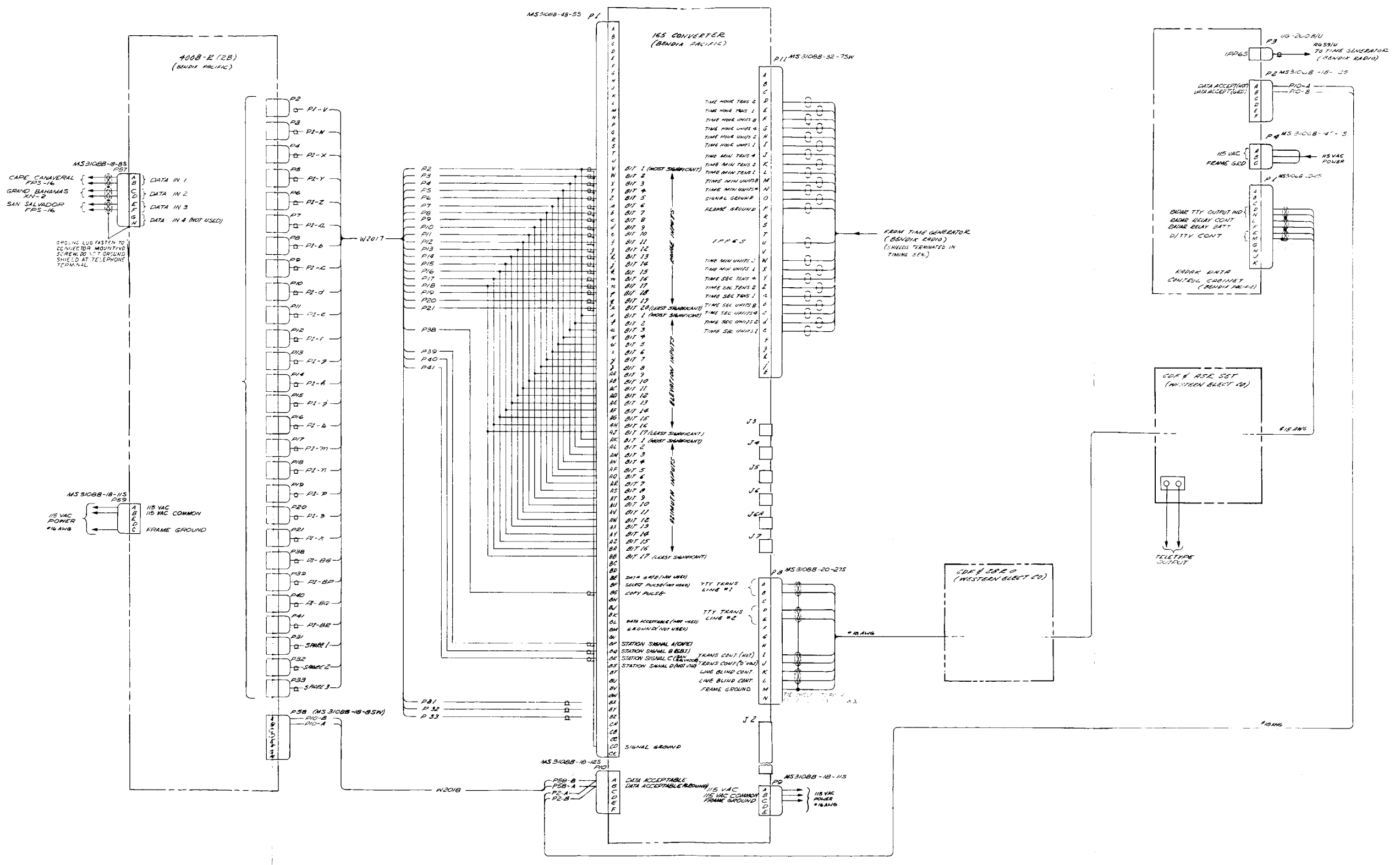


Figure 6-18. Wiring Diagram - Cape Canaveral (Sheet 1 of 2)

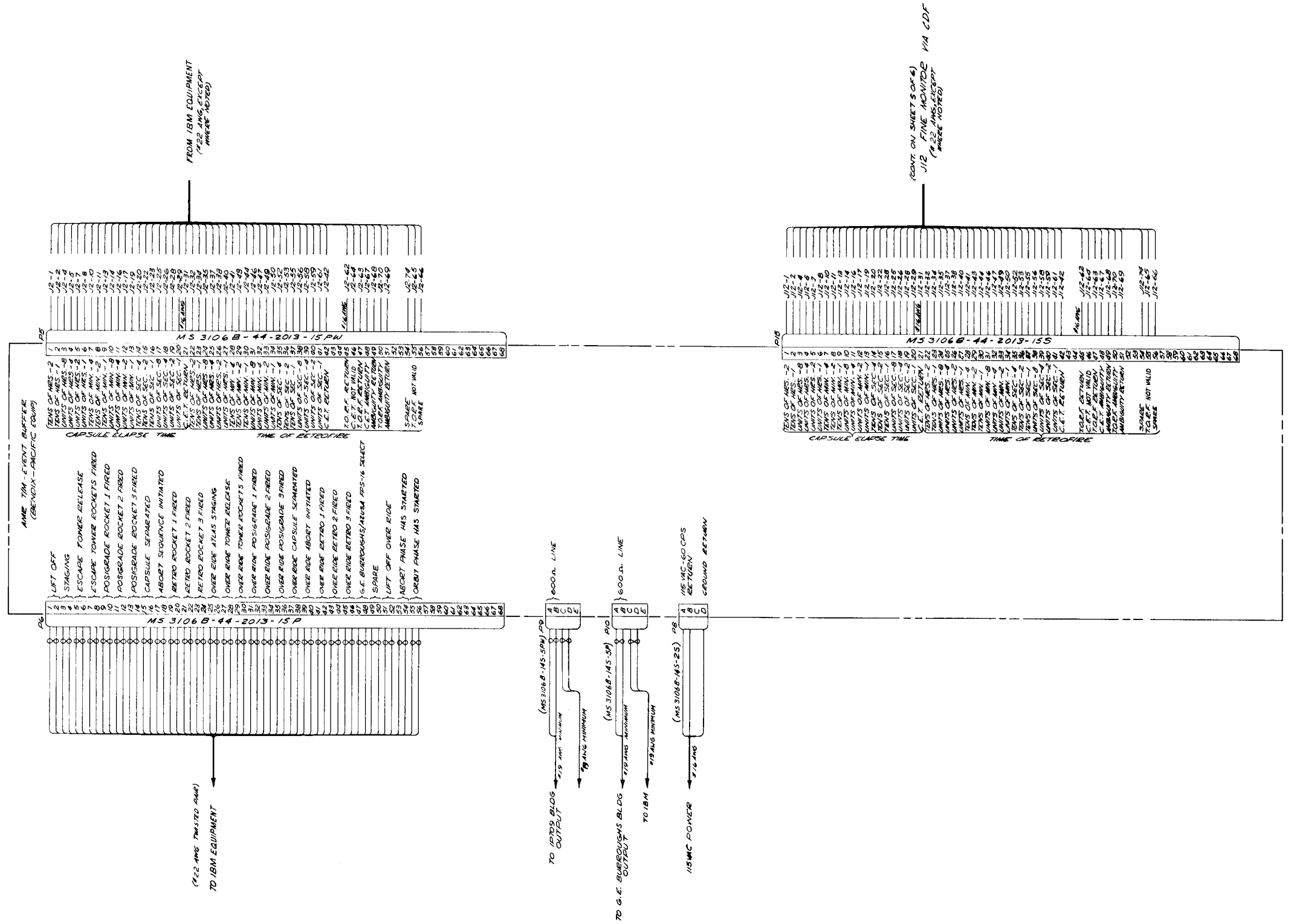


Figure 6-19. Wiring Diagram - Cape Canaveral
(Sheet 2 of 2)

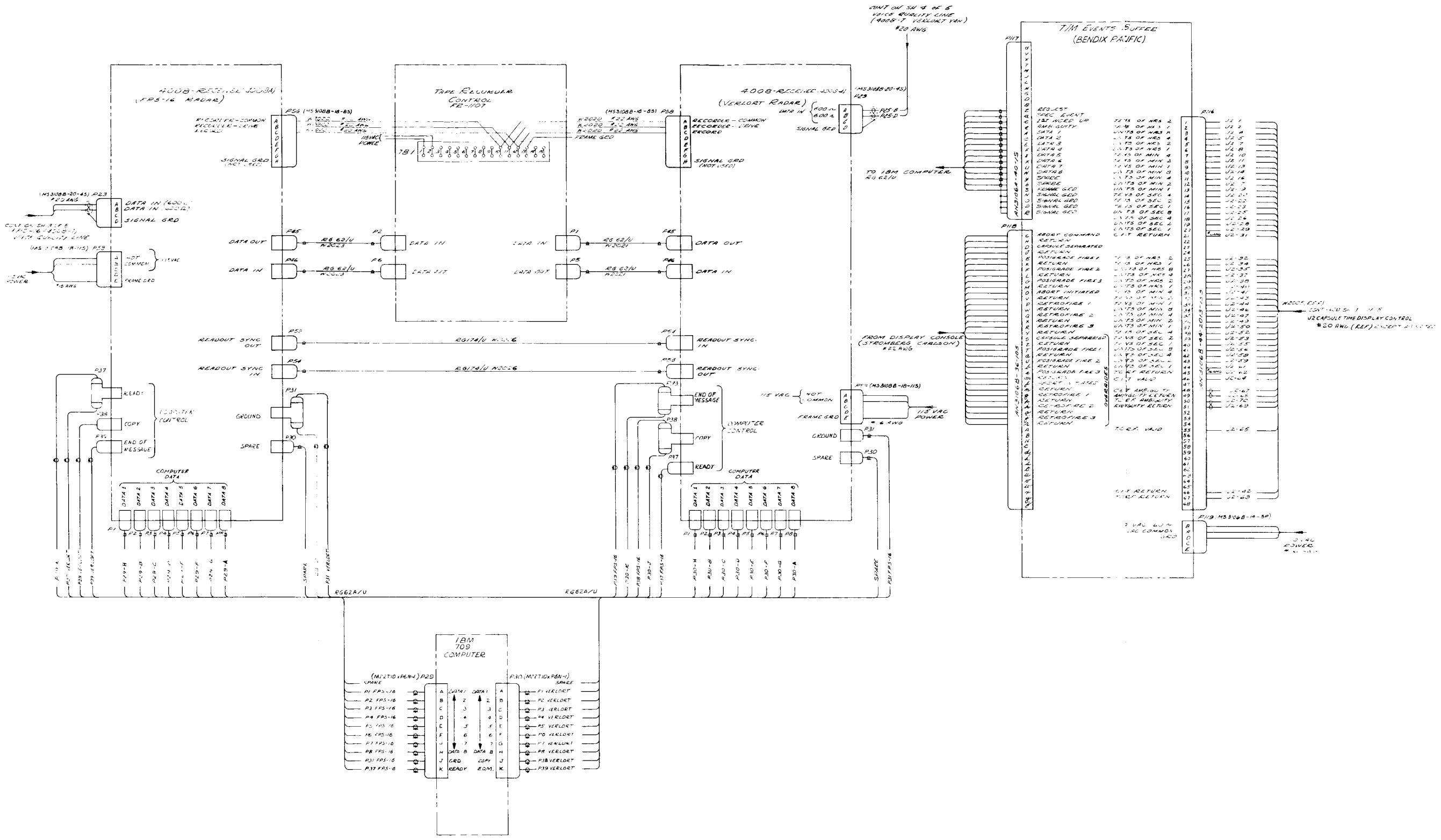


Figure 6-20. Wiring Diagram - Bermuda
(Sheet 1 of 3)

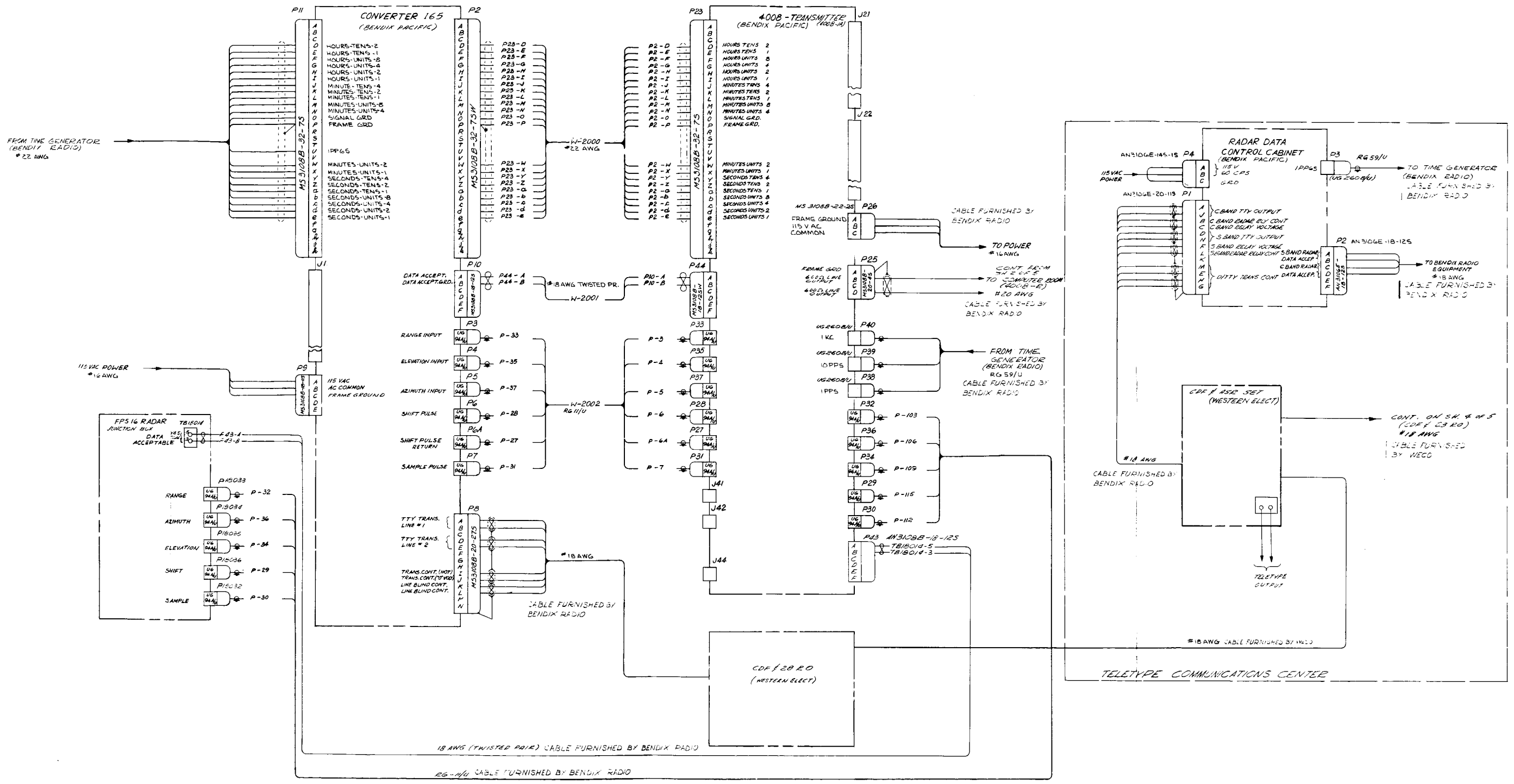


Figure 6-21. Wiring Diagram - Bermuda
(Sheet 2 of 3)

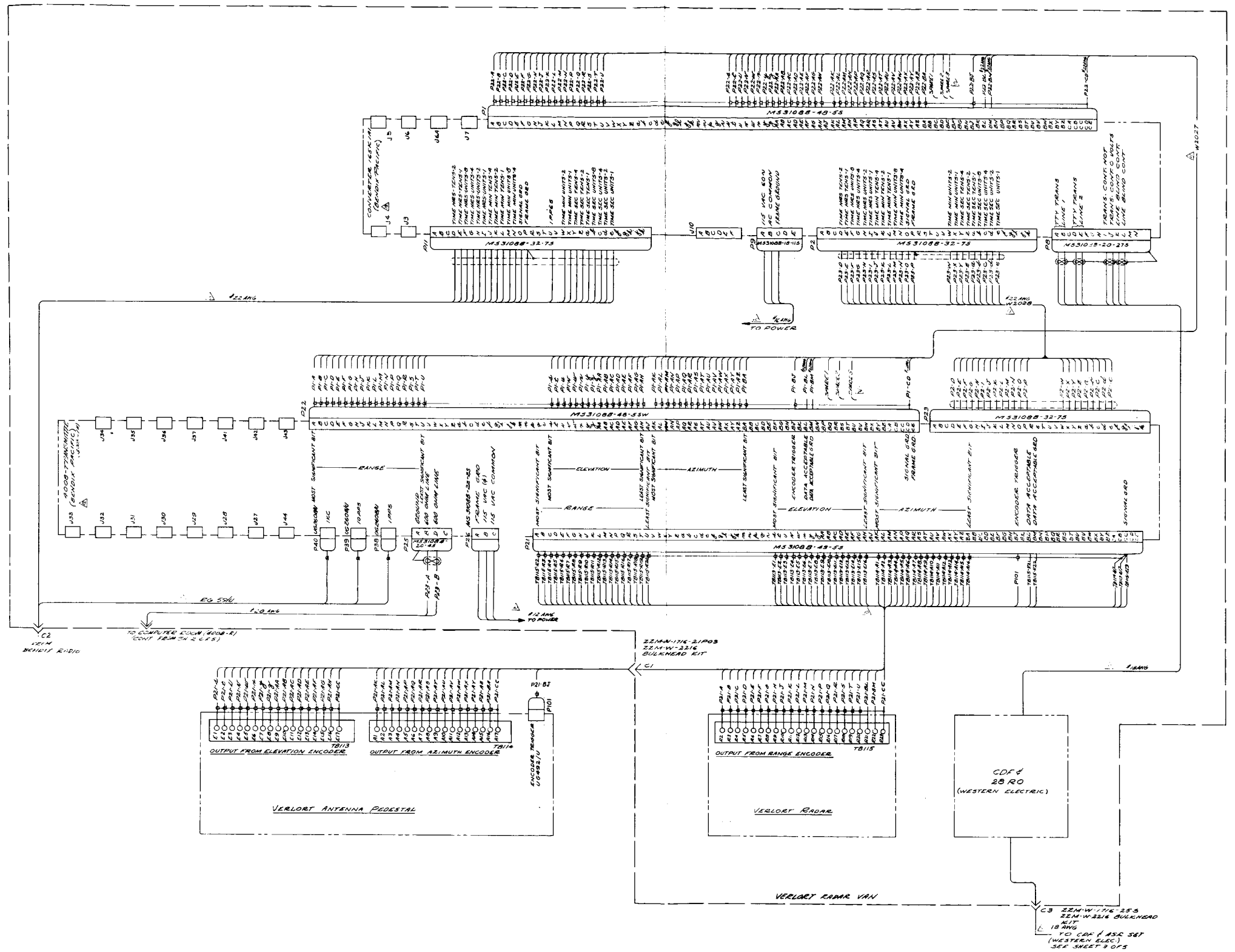
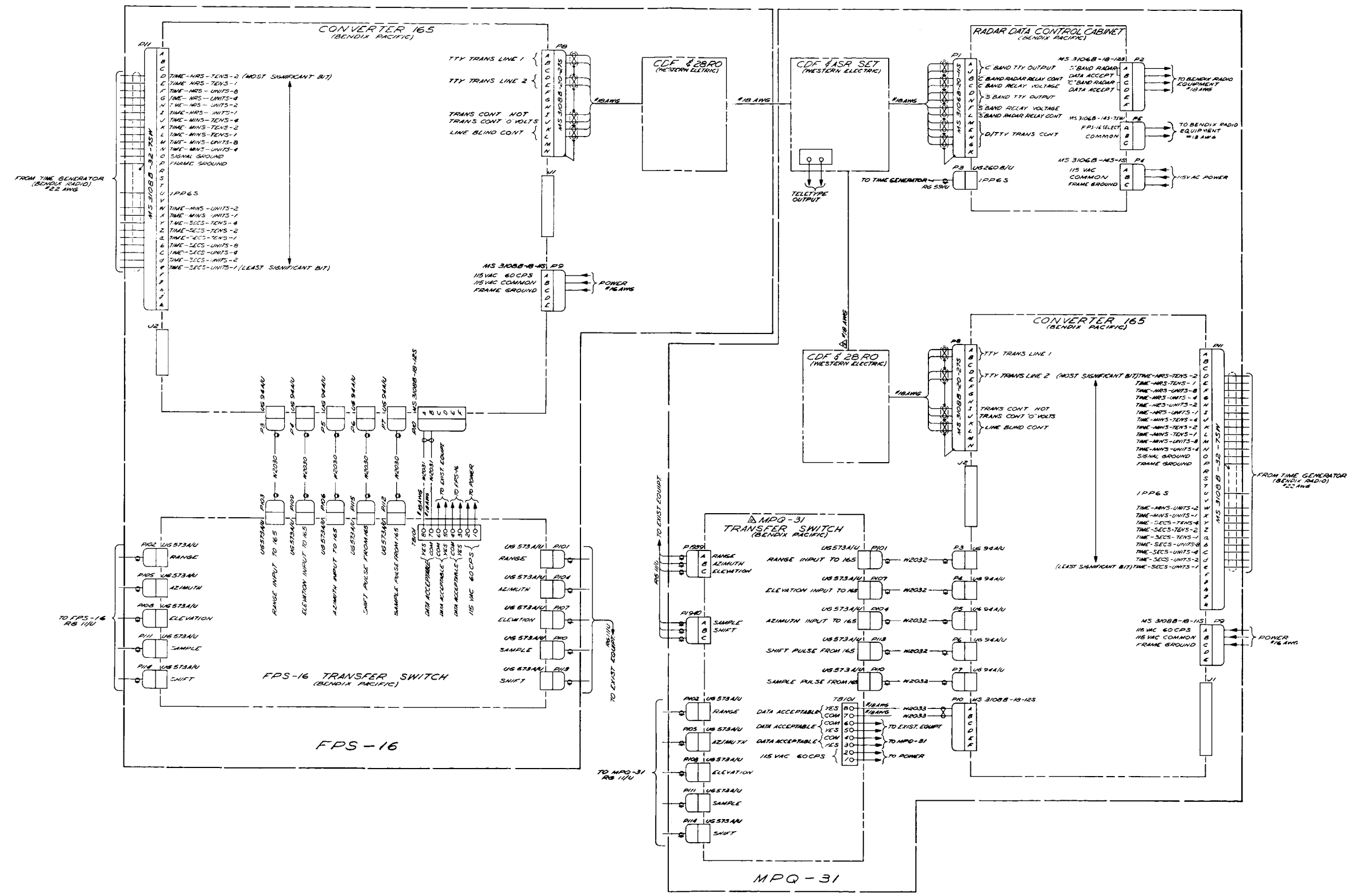


Figure 6-22. Wiring Diagram - Bermuda
(Sheet 3 of 3)



6-25

Figure 6-23. Wiring Diagram - Eglin

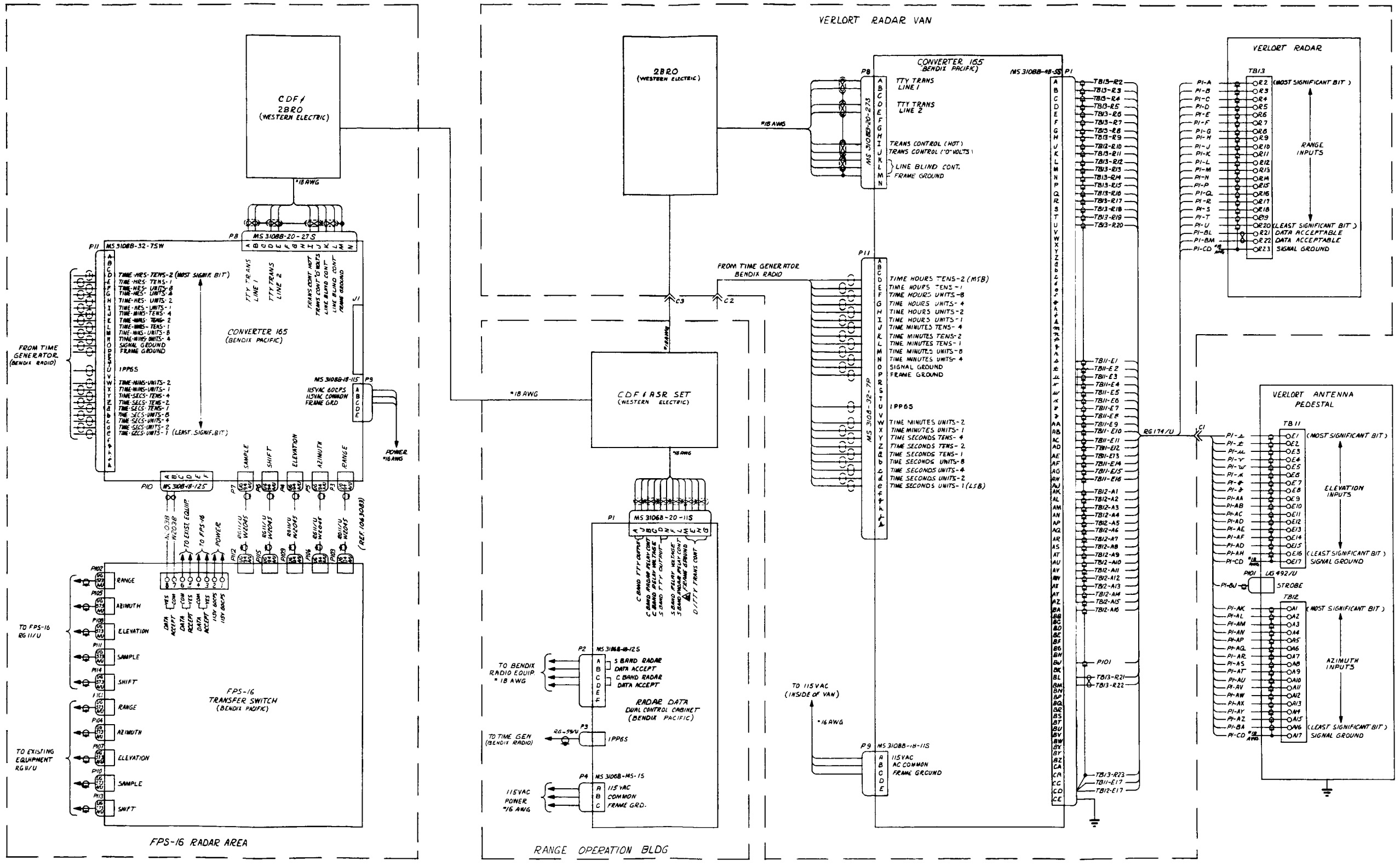


Figure 6-24. Wiring Diagram - Kauai Island and Point Arguello

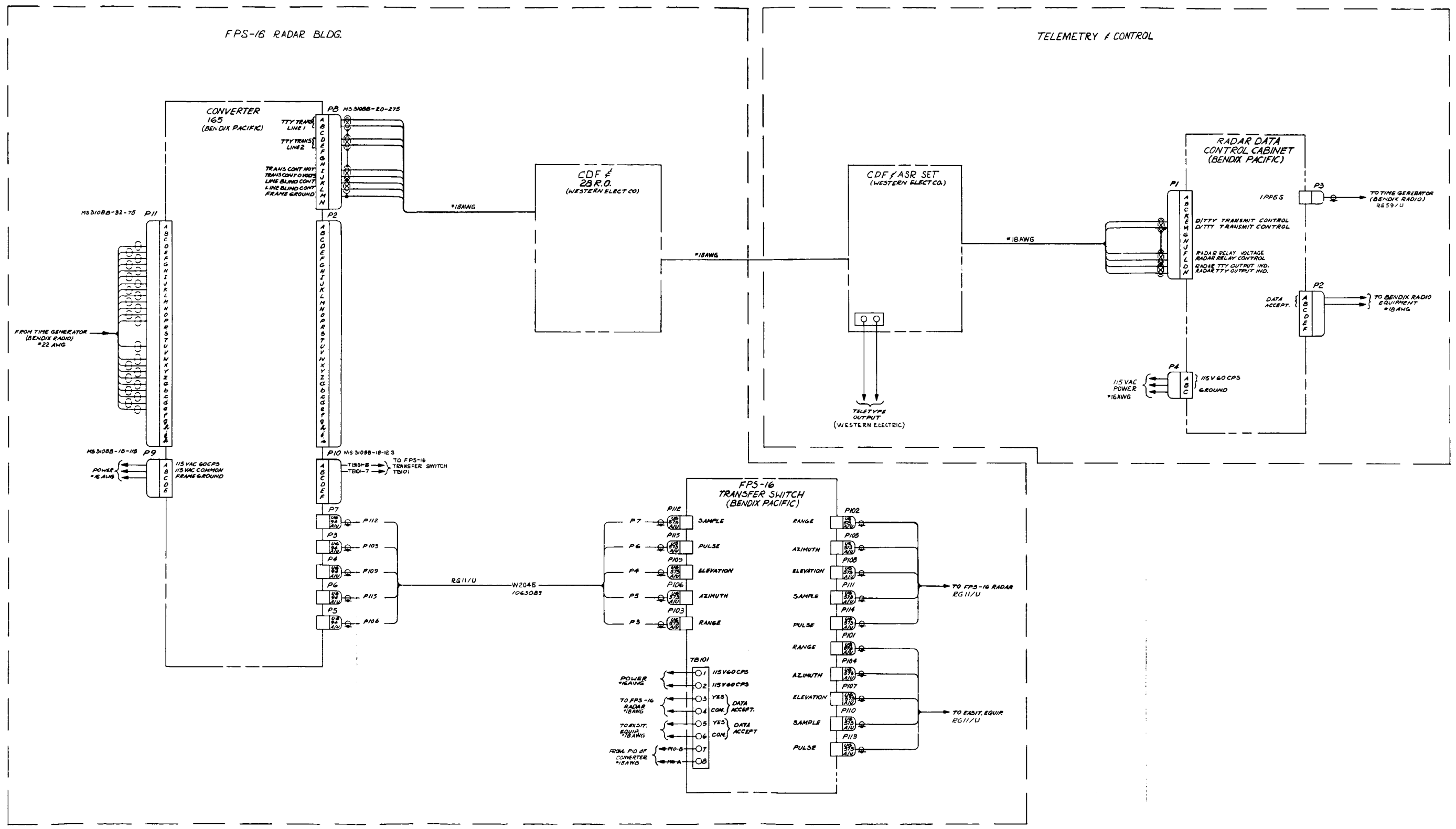


Figure 6-25. Wiring Diagram - Woomera

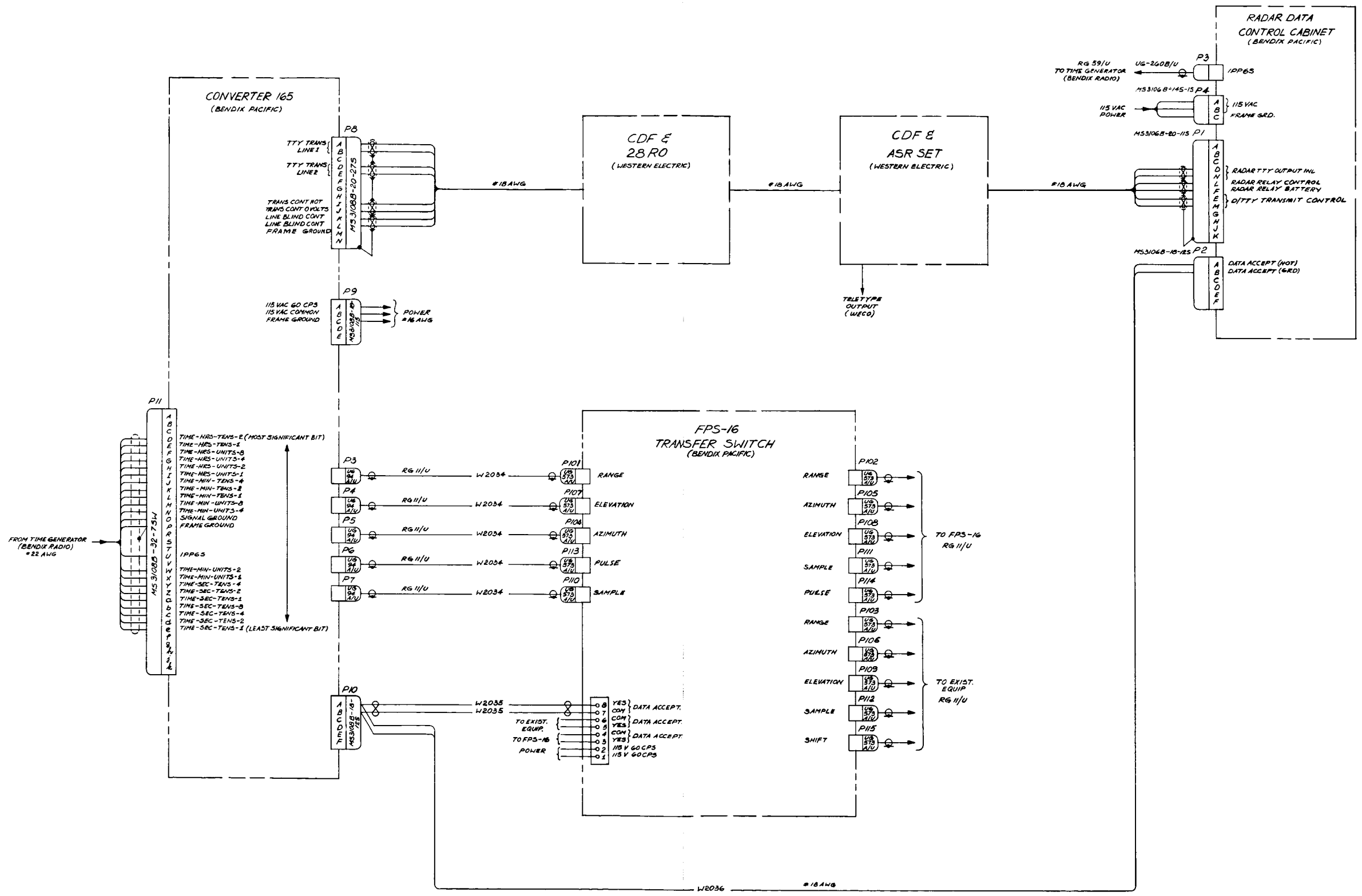


Figure 6-26. Wiring Diagram - White Sands

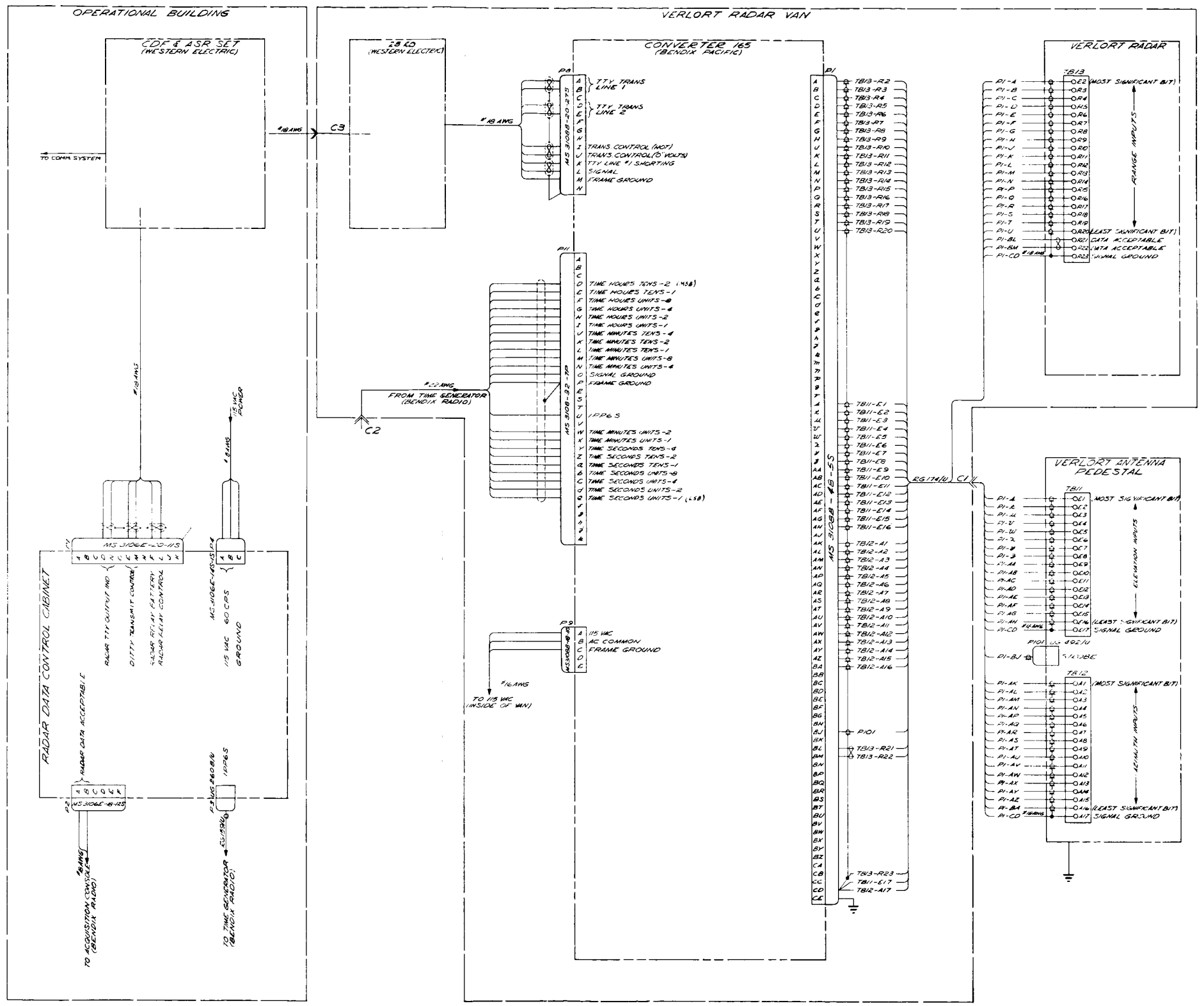


Figure 6-27. Wiring Diagram - Grand Canary Island and Corpus Christi

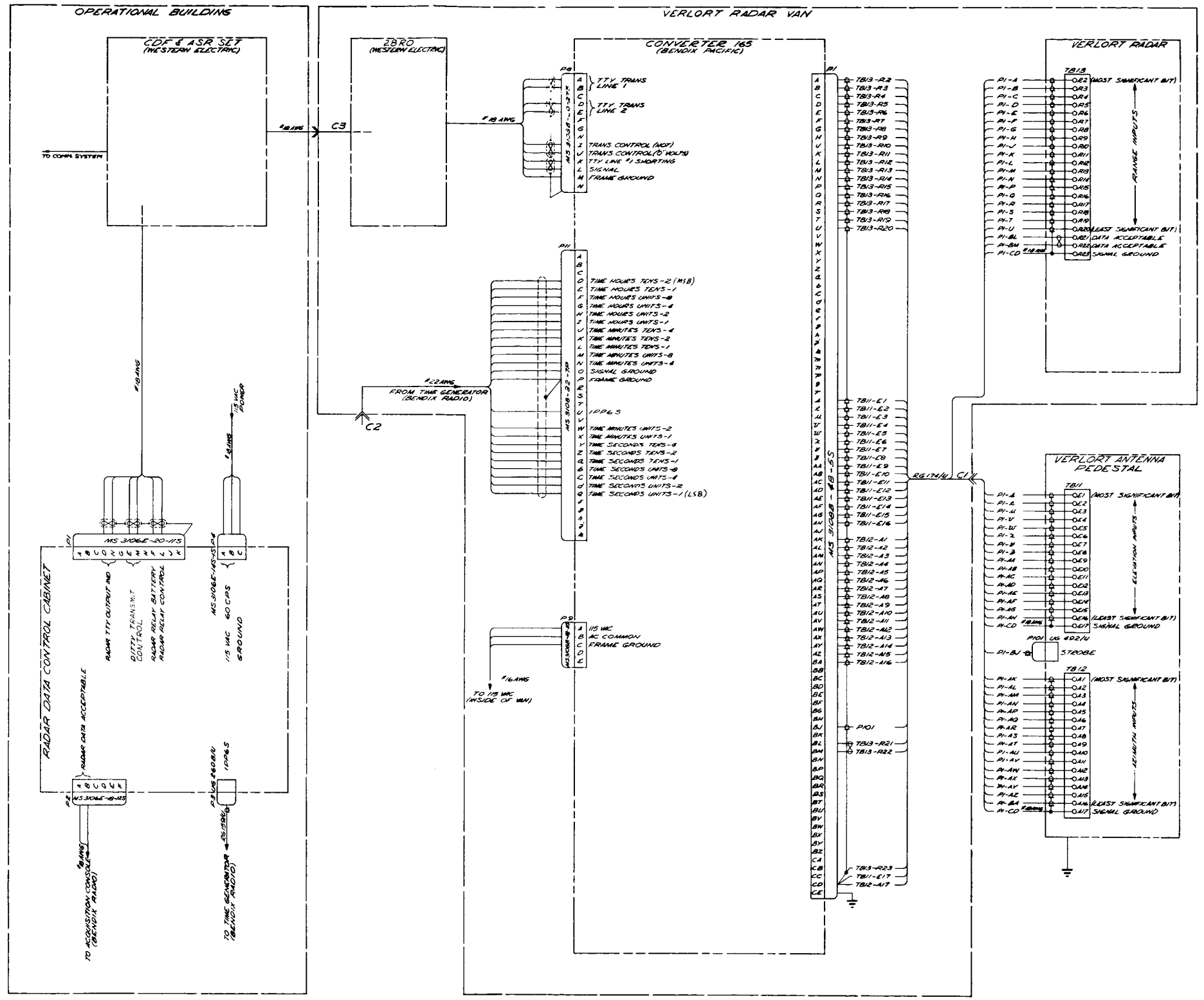


Figure 6-28. Wiring Diagram - Muchea and Guaymas

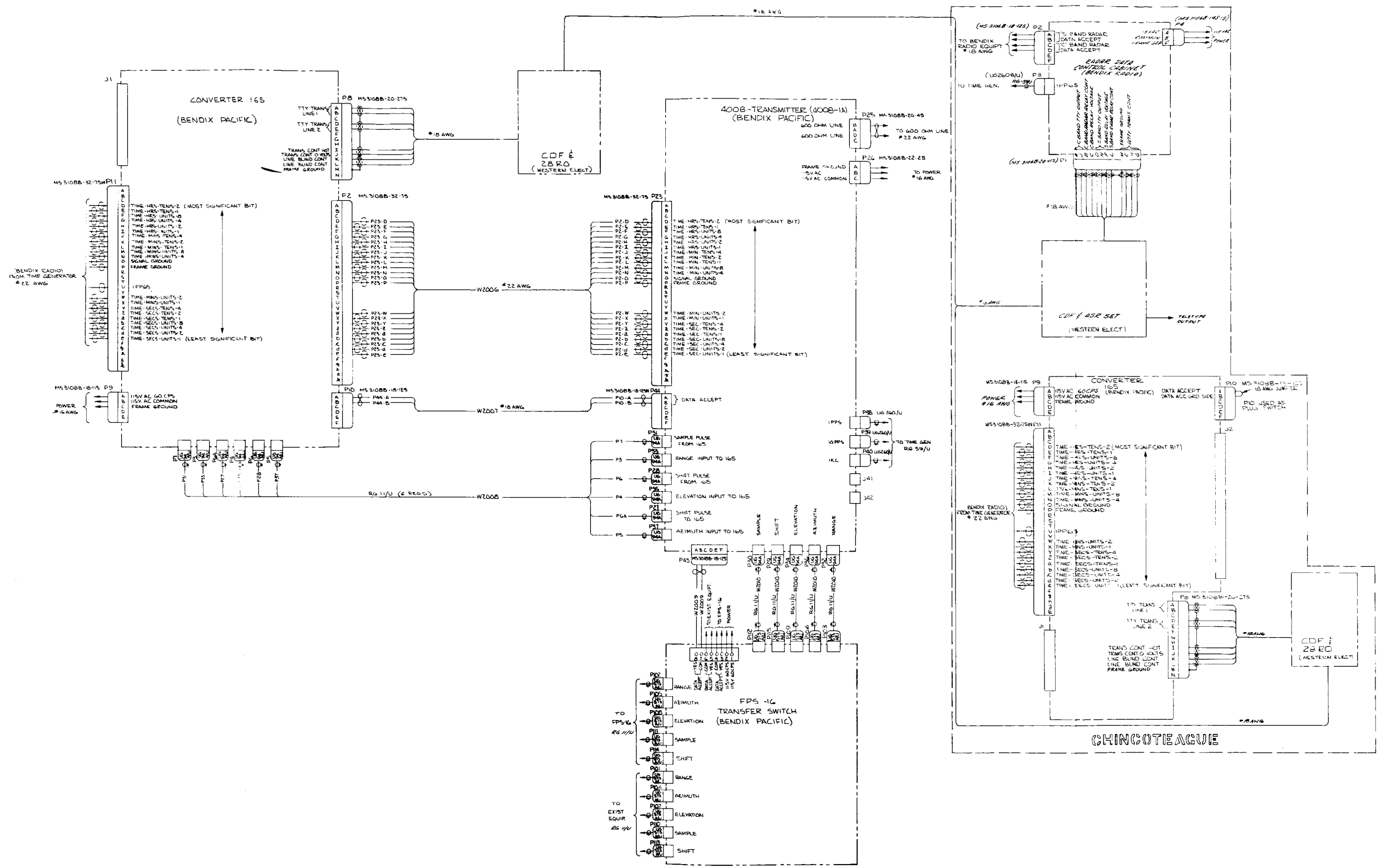


Figure 6-29. Wiring Diagram Wallops Island

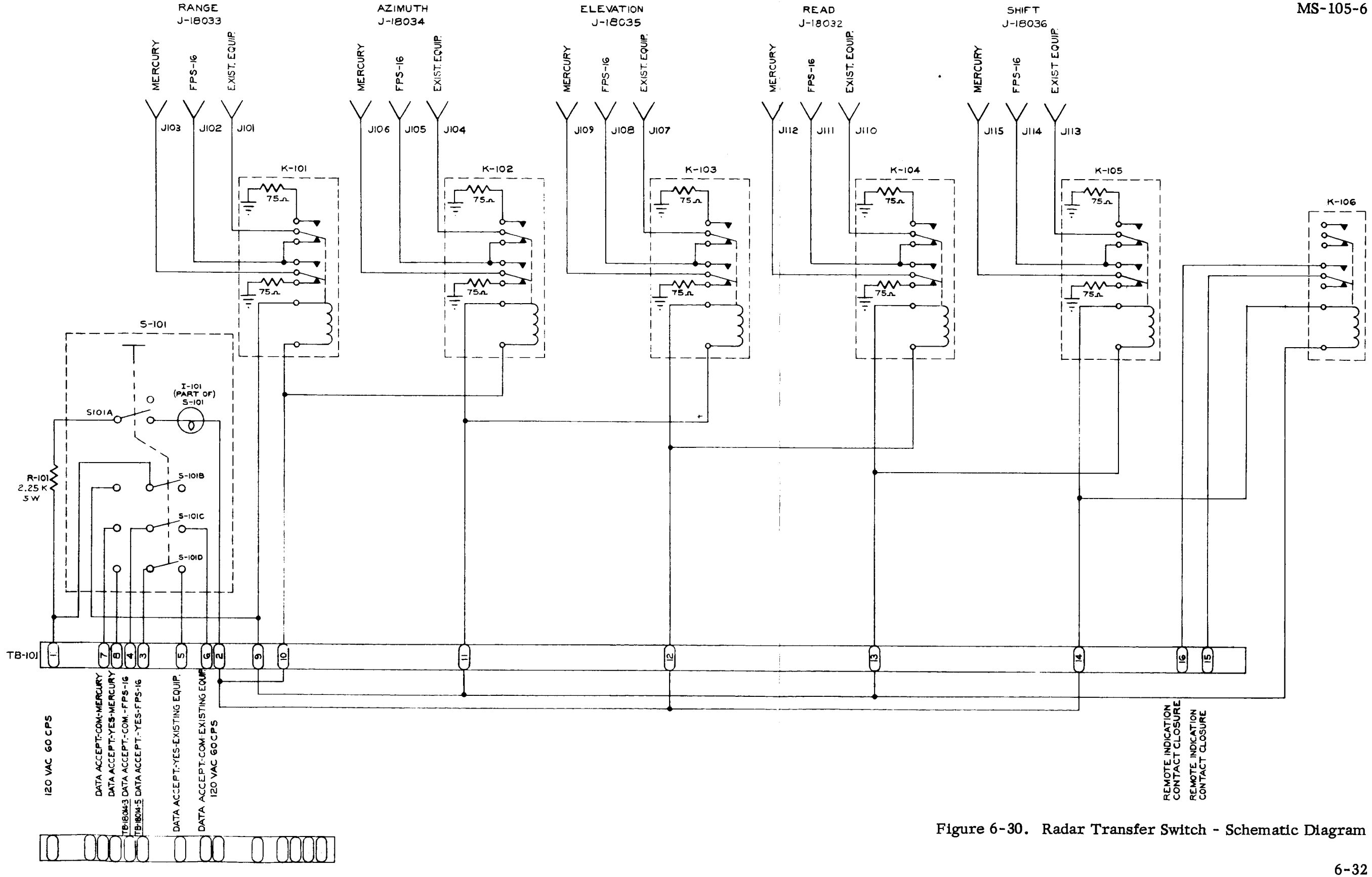


Figure 6-30. Radar Transfer Switch - Schematic Diagram